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PUBLICATIONS AND PATENTS

January-December 1976



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AGRICULTURAL RESEARCH SERVICE
ORGANIZATION DIRECTORY

Mr. Talcott W. Edminster
Administrator, ARS-USDA
Administration Building, USDA
Washington, D.C. 20250

Dr. H. C. Cox
Deputy Administrator
USDA-ARS-Western Region
2850 Telegraph Avenue
Berkeley, California 94705
Telephone: (415) 486-3565

Western Region covers Arizona,
California, Colorado, Hawaii,
Idaho, Montana, Nevada, New
Mexico, Oregon, Utah, Washington,
Wyoming.

Dr. Arthur W. Cooper
Deputy Administrator
USDA-ARS-Southern Region
P.O. Box 53326
New Orleans, Louisiana 70153
Telephone: (504) 589-6753

Southern Region covers Alabama,
Arkansas, Florida, Georgia,
Kentucky, Louisiana, Mississippi,
North Carolina, Oklahoma, Puerto
Rico, South Carolina, Tennessee,
Texas, Virgin Islands, Virginia.

Mr. Earl R. Glover
Deputy Administrator
USDA-ARS-North Central Region
2000 W. Pioneer Parkway
Peoria, Illinois 61614
Telephone: (309) 671-7176

North Central Region covers
Alaska, Illinois, Indiana, Iowa,
Kansas, Michigan, Minnesota,
Missouri, Nebraska, North Dakota,
Ohio, South Dakota, Wisconsin.

Dr. Steven C. King
Deputy Administrator
USDA-ARS-Northeastern Region
Room 333, Building 003
Agricultural Research Center, West
Beltsville, Maryland 20705
Telephone: (301) 344-3418

Northeastern Region covers
Connecticut, Delaware, Maine,
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Northern Regional Research Center
Agricultural Research Service
United States Department of Agriculture
1815 North University Street
Peoria, Illinois 61604

REQUEST FOR INFORMATION

Results of research investigations at the Northern Regional Research Center are published regularly in the technical literature, and public-service patents are secured to cover patentable inventions and discoveries (see page 90). As a convenient guide to our publications and patents, a list with abstracts is published periodically. These abstracts describe the current research and indicate the progress achieved. Further information on any of the developments, as well as earlier technical papers, may be obtained by writing us.

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PUBLICATIONS

[Publications marked with an asterisk (*) are not available for distribution at the Northern Regional Research Center. When requesting reprints, please order by number. Use your zip code.]

3806 • Kinds of Soy Products

W. J. Wolf

In "Edible Soy Protein. Operational Aspects of Producing and Marketing," U.S. Dep. Agric., Farmer Coop. Serv. Res. Rep. 33, pp. 3-11. January 1976

Edible soybean proteins are classified according to protein content: flours and grits, 40-50%; concentrates, 70%; and isolates, 90-95%. Initial applications of soybean proteins in foods were at low levels to provide desirable functional properties such as emulsification, water absorption, and texture. As animal proteins have risen in price, soy proteins have become more valuable as dietary protein sources, because they provide functional properties. The best example of food products utilizing soybean proteins for nutritional purposes are the textured soybean proteins now used as meat extenders and meat analogs. These are made by further processing of flours and grits, concentrates, and isolates. Each of these three basic protein forms are described as well as their conversion into textured products.

3807 • Product Uses

W. J. Wolf

In "Edible Soy Protein. Operational Aspects of Producing and Marketing," U.S. Dep. Agric., Farmer Coop. Serv. Res. Rep. 33, pp. 12-14. January 1976

The various soy protein products now available are added to a large number of food items for two reasons: (1) to provide functional properties and (2) to supply dietary protein. A functional property is one that imparts desirable changes to a food during processing or in the finished product. Examples of functional properties are water absorption, viscosity, emulsification, fat absorption, and texture. Use of soy proteins at high levels as a dietary source of protein is a recent development. The best examples of this application are the textured soy proteins that serve as extenders or complete replacements for meat. A major application of flours and grits is in bakery products.

3808 • Production Estimates and Market Outlets

W. J. Wolf

In "Edible Soy Protein. Operational Aspects of Producing and Marketing," U.S. Dep. Agric., Farmer Coop. Serv. Res. Rep. 33, pp. 15-17. January 1976

Soy flours and grits, the first edible soybean protein products produced commercially, have been available for about 40 years but they were not very successful initially because of poor flavor, dark color, and a high content of hulls. After World War II, however, the industry began to improve the flour and grits products and to develop markets for them. Precise figures on amounts of soybean proteins produced annually are not available because manufacturers consider this proprietary information. However, two recent production estimates as well as recent selling prices are given. Quantitative information on market outlets is also difficult to obtain, but estimates have been made that indicate relative magnitudes of the various outlets involved.

3809 • Soy Processes, Equipment, Capital, and Processing Costs

G. C. Mustakas and V. E. Sohns

In "Edible Soy Protein. Operational Aspects of Producing and Marketing," U.S. Dep. Agric., Farmer Coop. Serv. Res. Rep. 33, pp. 18-34. January 1976

Five basic commercial edible soybean products and their processes for manufacturing were chosen for this analysis: (1) full-fat soy flour, (2) defatted soy flour, (3) soy protein concentrates, (4) soy protein isolates, and (5) textured soy protein produced from soy flour. Selection of products was based on the idea that soy processing cooperatives would manufacture basic and intermediate products that could be marketed as raw materials as well as used for finished foodstuffs. Substantial investments have been made by the soybean industry in these intermediates; textured soy protein is the most recently developed product.

Cost estimates for the various processes described were prepared largely from data contained in patent literature and other published sources, and from data supplied by equipment manufacturers. Although the various products are made commercially, data on such production are limited and not readily available, and thus are inadequate for preparing cost estimates. Therefore, these cost estimates must be considered preliminary figures only and are intended to serve merely as guidelines for studying the feasibility of producing soy protein materials. Costs are reported as of mid-1974.

3810 • Market Growth

W. J. Wolf

In "Edible Soy Protein. Operational Aspects of Producing and Marketing," U.S. Dep. Agric., Farmer Coop. Serv. Res. Rep. 33, pp. 40-45. January 1976

Various factors have helped to establish present markets for soybean proteins and also will influence the growth of future markets: economics, growth of processed foods market, flavor characteristics, functional properties, nutritional properties, government regulations, and consumer acceptance. Not all of these determinants of growth are of equal importance, but some of them are interrelated. For example, flavor of a protein ingredient can have a favorable or unfavorable effect on consumer acceptance. On the other hand, if Government regulations prohibit or severely limit protein additives in a particular food, low price and excellent functional properties are of little or no importance.

3811* • Food Proteins in Perspective

G. E. Inglett

In Symp. "...Worldwide Developments in Food Protein," Prepr. Pap., Div. Chem. Mktg. Econ., Am. Chem. Soc., First Chem. Conf. N. Am. Cont., Mexico City, Mexico, pp. 59-60. 1975

Proteins are indispensable components of food for all people. Their absence in the diet of humans or animals is certain death. This symposium considers worldwide protein resources for the human diet

3812* • Processing Cereals for Food Proteins

G. E. Inglett

In Symp. "...Worldwide Developments in Food Protein," Prepr. Pap., Div. Chem. Mktg. Econ., Am. Chem. Soc., First Chem. Conf. N. Am. Cont., Mexico City, Mexico, pp. 125-138. 1975

Cereal protein products are prepared by mechanical separation, wet-milling procedures, or various combinations of these techniques. Corn and wheat embryos, for example, are concentrated on sieves before these protein-rich fractions are converted into flours. Air classification is a valuable method for concentrating protein from cereal flours. Wet-milling procedures are well adapted to preparing protein-rich concentrates and isolates from corn, wheat, oats, and other cereal grains.

- 3813 • Oxidized Phosphatidylcholines from Defatted Soybean Flakes Taste Bitter
David J. Sessa, Kathleen Warner, and Joseph J. Rackis
J. Agric. Food Chem. 24(1): 16-21. January-February 1976

Three phosphatidylcholines differing in chromatographic mobility on thin-layer plates were isolated from residual lipids of hexane-defatted soy flakes. These soy phosphatidylcholines (SPC) were designated SPC-A, SPC-B, and lyso-SPC. All three possessed keto and hydroxy fatty acid esters but no aldehydic esters. A seven-member panel rated 0.05% suspensions of these phospholipids for intensity of bitter taste, based on the scoring system 0 = none to 3 = strong. Suspensions of SPC-A scored 0.9. Both SPC-B and lyso-SPC at the 0.05% level rated 3.0 and upon reevaluation at 0.01% scored about 1.0. Based on recovered weights, these phosphatidylcholines represent a minimum of 0.08% in defatted flakes. They may well contribute to the bitter taste in soy flakes.

- 3814 • Toxicity to White Mice of Corn Naturally Contaminated with Aflatoxin
Lloyd A. Lindenfelser, Eivind B. Lillehoj, and Gerald A. Sansing
J. Agric. Food Chem. 24(1): 198-200. January-February 1976

Male and female mice of three different ages were fed continuously on balanced corn diets containing naturally occurring aflatoxin. The corn contained 286 p.p.b. of aflatoxin and was fed in diets containing 5, 20, and 40% (14, 57, and 114 p.p.b.) contaminated grain for 6 months. Animals were regularly observed for weight changes, general health, or toxicity symptoms, and at the end of the experiment their livers were examined for total lipid content. Weight gains of mice fed the highest aflatoxin levels were approximately the same as those on rations containing lower levels. No tumors were observed, but lipid accumulation in the liver was significant in animals ingesting the highest level of toxin-contaminated feed.

- 3815 • Crambe Seed Processing: Removal of Glucosinolates by Water Extraction
G. C. Mustakas, L. D. Kirk, E. L. Griffin, Jr., and A. N. Booth¹
(¹Western Regional Research Center, ARS, USDA, Albany, Calif.)
J. Am. Oil Chem. Soc. 53(1): 12-16. January 1976

A method is reported for removing *epi*-progoitrin, the major glucosinolate from crambe seed meal. Defatted meal was cooked and water extracted or treated with soda ash and then water extracted. Although soda ash aided

destruction and removal of glucosinolate factors, there was a 28% reduction in total lysine. In animal feeding tests designed to reflect differences due to toxic factors, soda ash-treated and water-extracted meals gave the best results. No toxicity was apparent in rats and chicks fed these meals in nutritionally adequate diets. The rat diet included 30% crambe meal for 90 days; the chick diet, 20% crambe meal for 4 weeks. Pathological examinations in both series showed no organ damage.

3816 • Rigid Polyurethane Foams from Diethanolamides of Carboxylated Oils and Fatty Acids

T. H. Khoe and E. N. Frankel

J. Am. Oil Chem. Soc. 53(1): 17-19. January 1976

New polyols of high hydroxyl content and reactivity were made from linseed and soybean oils and acids by catalytic carboxylation followed by reaction with diethanolamine. Urethane foams made with these diethanolamides were stronger than those made with castor oil at equivalent polyol weight. Because of their higher hydroxyl content, a larger amount of diethanolamides could be incorporated in foam formulations than is possible with castor oil. The rigid urethane foams prepared with the new polyols meet the requirements of commercial products with respect to density, compressive strength, and dimensional stability.

3817 • Poly(Amide-Acetals) and Poly(Ester-Acetals) from Polyol Acetals of Methyl 9(10)-Formylstearate: Preparation and Physical Characterization

R. A. Awl, W. E. Neff, D. Weisleder, and E. H. Pryde

J. Am. Oil Chem. Soc. 53(1): 20-26. January 1976

Condensation polymers were prepared from the pentaerythritol acetal of methyl 9(10)-formylstearate by reaction with diamines and with ethylene glycol. The glycerol acetal was self-condensed to a poly(ester-acetal) and also copolymerized with caprolactam. A novel step growth, addition polymerization was carried out with ethylene bis[9(10)-methoxymethylene-stearate] and pentaerythritol. Physical and spectral (infrared and nuclear magnetic resonance) properties of the various products were determined. In general, the long C₈-C₉ side chains in the polymers of the pentaerythritol acetal of methyl 9(10)-formylstearate reduced crystallinity to such a degree that, unlike polymers from methyl azelaaldehyde pentaerythritol acetal, they were soluble in the more ordinary solvents, e.g., chloroform and tetrahydrofuran.

- 3818 • Dough Conditioners for 12% Soy-Fortified Bread Mixes
 G. N. Bookwalter and C. L. Mehltretter
 J. Food Sci. 41(1): 67-69. January-February 1976

Dough conditioners in waxy solid and fluid forms were prepared by (1) reactions of starch or lactose with glycerol or propylene glycol; (2) alkoxylation of polyol glycosides with ethylene oxide or its mixture with propylene oxide; and (3) transesterification with methyl esters of oleic, stearic, or palmitic acid or triglyceride mixtures. Dry mixes of these experimental dough conditioners were prepared by chilling and grinding the waxy conditioners to powder form and blending with defatted soy flour. Grinding of the waxy products was facilitated by incorporation of up to 10% fully hydrogenated soybean oil flakes (HSF). Fluid conditioners were added directly and blended with soy flour. When tested at the 0.5% level in 12% soy-fortified wheat bread, functional properties were the same whether the experimental dough conditioners were added to the bread formula either by dissolving in water or as a dry mix with the soy flour and wheat flour. Baking results were not affected by the incorporation of up to 10% HSF with the waxy products. The 12% soy-fortified bread containing waxy or fluid dough conditioner had substantially improved loaf volume, grain, and crumb color when compared to control bread with no conditioner. FDA approval of these new dough conditioners for food use has not yet been obtained.

- 3819 • Protein and Amino Acid Compositions of Dry-Milled and Air-Classified Fractions of Triticale Grain
 A. C. Stringfellow, J. S. Wall, G. L. Donaldson, and
 R. A. Anderson
 Cereal Chem. 53(1): 51-60. January-February 1976

Protein contents and amino acid compositions were determined on fractions obtained by roller milling, fine grinding, and air classifying one spring and two winter triticale varieties. Because the triticale grains have protein levels equivalent to the hard wheats but higher lysine contents, the grain fractions were explored as sources of high-protein flours suitable for use as supplements in cereal products. The three triticale grains were first processed in a laboratory roller mill through three break and three reduction steps to give a total flour extraction of 62-65%. Variations in the protein and lysine contents of the flour milling fractions reflected differences in the distribution of proteins in the endosperm. Bran fraction and shorts were high in protein and lysine owing to their germ and aleurone content. The triticales, especially the Texas-grown spring variety, behaved like soft wheats upon fine grinding and air classification. Yields of the high-protein fractions and their protein levels were generally superior to those of hard wheats. Low levels of coarse residues from the reground flour remained after seven steps of air classification. The high-protein fractions of triticale flours have lysine contents comparable to that of the initial flour.

- 3820 • Chromatographic Methods in the Determination of Absolute and Relative Configurations of Fatty Acids
C. R. Smith, Jr.
J. Chromatogr. Sci. 14(1): 36-40. January 1976

Chromatographic techniques for determination of configurations of branched and substituted long-chain fatty acids, both absolute and relative, are reviewed. Gas-liquid chromatographic and thin-layer chromatographic procedures are emphasized.

- 3821* • Bacteria as Insect Pathogens
Lee A. Bulla, Jr.,¹ Robert A. Rhodes, and Grant St. Julian
(¹U.S. Grain Marketing Research Center, ARS, USDA,
Manhattan, Kansas)
Annu. Rev. Microbiol. 29: 163-190. 1975

Interest in bacterial insect pathogens is primarily related to the utilization of the organisms to control pest insects. However, there are other theoretical implications that are important to consider. Particularly, invertebrates possess agglutinins in their hemolymph that can clump a variety of animal cells and that exhibit specificity for human erythrocyte blood groups. Although these agglutinins are probably not produced by mechanisms similar to those concerned in antibody production, both have in common a defense function. In invertebrates, including insects, these substances are responsible for parasite immobilization as well as for antiviral and bacteriocidal activity. Most of the experimental questions asked so far are very general. It is hoped that with the advent of new insect tissue culture systems and cell lines, bacterial insect pathogens will be used to gain more basic knowledge of animal defense mechanisms.

Man associates with insects and insect diseases from time to time. Insects are important vectors of human disease and the pathogens concerned do not generally infect the insect. The fact that insects harbor bacteria that infect man and other animals raises intriguing questions concerning insect immunity to such pathogens. More intensive investigations on the comparative aspects of insect and vertebrate immune responses would shed considerable light on the phylogenetic evolution of disease. Certainly, information acquired from such studies would enhance our knowledge of pathogens and diseases while permitting a greater understanding of their use in controlling economically important insects and a keener appreciation of how to suppress diseases of beneficial insects and other invertebrates.

3822 • Acid-Sensitive Soy Proteins Affect Flavor

Robert L. Anderson and K. Warner

J. Food Sci. 41(2): 293-296. March-April 1976

The acid-sensitive fraction (ASF) is easily removed from other soy proteins because it precipitates from 1 M NaCl at pH 4.5. This precipitation provides the basis for an ASF assay. An ASF-containing sample series was compared by disc gel electrophoresis with an analogous series after ASF elimination. These two series were also evaluated by a trained 12-member taste panel. Six prominent and several minor proteins throughout the gels and unresolved protein near the top of the gels appear to be associated with ASF. Disc gel electrophoresis reveals that water-extractable proteins, acid-precipitated curd, and whey proteins contain ASF. Its removal significantly increased flavor scores; the most noticeable change is a decrease in intensity of grassy-beany flavor. Evidently ASF has a greater affinity for grassy-beany flavor compounds than do non-ASF proteins.

3823 • Hydrolysis of Corn Oil by Lipase from *Helminthosporium maydis* Race T

G. A. Bennett, S. Freer, and O. L. Shotwell

J. Am. Oil Chem. Soc. 53(2): 52-53. February 1976

Corn oil served as the sole carbon source for growth of *Helminthosporium maydis* Race T (NRRL 5128) in shaken flasks at 28° C. Oil recovered by hexane extraction from culture medium and mycelia at 2-day intervals was analyzed by thin-layer chromatography and gas chromatography. Triglyceride content of the oil was reduced, whereas free fatty acid, monoglyceride, and diglyceride contents increased as a result of *H. maydis* growth. Free sterol and steryl ester contents were unaffected. Lipase production was demonstrated by *H. maydis* cells grown on corn oil, but the enzyme was not detected in cells grown on sucrose.

3824 • Addition of *N*-Acetylcysteine to Linoleic Acid Hydroperoxide

H. W. Gardner, D. Weisleder, and R. Kleiman

Lipids 11(2): 127-134. February 1976

Catalyzed by 10^{-5} M ionic iron in 80% ethanol, *N*-acetylcysteine added to linoleic acid hydroperoxide, forming a thio-bond. Reaction of a specific isomer of the hydroperoxide, 13-hydroperoxy-*trans*-11,*cis*-9-octadecadienoic acid, and *N*-acetylcysteine, forms a number of products, of which two were identified as addition compounds. One addition product was 9-*S*-(*N*-acetylcysteine)-13-hydroxy-10-ethoxy-*trans*-11-octadecenoic acid, and the other was 9-*S*-(*N*-acetylcysteine)-10,13-dihydroxy-*trans*-11-octadecenoic acid.

3825 • Dual-Labeled Technique for Human Lipid Metabolism Studies Using Deuterated Fatty Acid Isomers

E. A. Emken, W. K. Rohwedder, H. J. Dutton, R. Dougherty,¹
J. M. Iacono,¹ and J. Mackin²

(¹Nutrition Institute, ARS, USDA, Beltsville, Md.; ²Georgetown Medical School, Washington, D.C.)

Lipids 11(2): 135-142. February 1976

Two deuterated fatty acids, elaidate- d_2 and oleate- d_4 , were fed simultaneously to a human subject as a mixture of trielaidin- d_6 and triolein- d_{12} . Periodically, blood samples were drawn, and red blood cells were separated from the plasma. Red blood cells and plasma lipids were fractionated and analyzed by combined gas chromatography-multiple ion mass spectroscopy. Dual deuterium-labelling allows rate and extent of fatty acid incorporation to be followed in various plasma and red cell neutral and phospholipid fractions. Maximum amount of deuterated fat varied from 4% in cholesterol ester to 64% in phosphatidyl ethanolamine. The highest levels of deuterated fat occurred in either 6-, 8-, or 12-hr. samples; generally, <1% labeled fatty acids could be detected in 72-hr. samples. Because the method is based on dual-labeling, differences in the relative incorporation of both fatty acid isomers can be compared directly. Differences in rates of incorporation, rates of removal, and extent of incorporation of labeled fatty acids into blood plasma can also be determined reliably. Our experimental labeling of fats with deuterium permits for the first time the metabolism of two fatty acid isomers to be compared simultaneously in human subjects. This new method should be applicable to a variety of other lipid metabolic studies.

3826 • γ -Linolenic Acid in *Acer* Seed Oils

M. B. Bohannon and R. Kleiman

Lipids 11(2): 157-159. February 1976

The octadecatrienoic acids in *Acer negundo* L. (maple family) seed oil include both 9,12,15- (1%) and 6,9,12- (7%) isomers. The chief monoenoic acids identified were 9-octadecenoic (21%), 11-eicosenoic (7%), 13-docosenoic (15%), and 15-tetracosenoic (7%). Also present is a considerable amount of 9,12-octadecadienoic acid. Investigation of ten other Aceraceae revealed their seed oils to have a similar fatty acid composition.

3827 • Survey of U.S. Wheat for Ochratoxin and Aflatoxin

Odette L. Shotwell, Marion L. Goulden, and Clifford W. Hesseltine
J. Assoc. Off. Anal. Chem, 59(1): 122-124, January 1976

A total of 291 hard red winter wheat samples, 286 hard red spring wheat samples, and 271 soft red winter wheat samples were analyzed for the

presence of ochratoxin and aflatoxin. Samples in all grades came from those collected during crop years 1970-1973 for grade determination by the Agricultural Marketing Service, U.S. Department of Agriculture. Sensitivity limits of the analytical method as carried out were 1-3 p.p.b. aflatoxin B₁ and 15-30 p.p.b. ochratoxin A. No aflatoxin was detected in any sample. Three samples of hard red winter wheat (Grades U.S. No. 4 and 5 and Sample Grade) contained ochratoxin A (trace, 35, and 25 p.p.b., respectively). Eight of the hard red spring wheats contained ochratoxin A (15-115 p.p.b.); these were in Grades U.S. No. 4 and 5 and Sample Grade.

- 3828* • Crystal and Molecular Structure of Cephalotaxine
 Satish K. Arora,¹ Robert B. Bates,¹ Raymond A. Grady,¹
 Gabriel Germain,² Jean P. Declercq,² and Richard G. Powell
 (¹University of Arizona, Tucson; ²Laboratoire de Chimie-
 Physique, Louvain-la-Neuve, Belgium)
 J. Org. Chem. 41(3); 551-554, February 1976

The natural antileukemic esters of cephalotaxine include homoharringtonine, which is undergoing preclinical testing. As these esters are unfortunately noncrystalline, x-ray studies to reveal the conformational preferences of the cephalotaxine portion are limited to other derivatives, e.g., cephalotaxine *p*-bromobenzoate. Prior to our study of the latter derivative, we had initiated an x-ray study on cephalotaxine itself; after an uneventful data collection, we were unable to solve the phase problem by direct methods. Recently, vector search methods have revealed the structure, and we now report the conformations of the two independent cephalotaxine molecules in these crystals.

- 3829* • Ethanol Fermentation and Potential
 Dwight L. Miller
 Biotechnol. Bioeng. Symp. No. 5: 345-352. 1975

Ethyl alcohol is one of the major chemicals of the United States and of the world. The U.S. industrial alcohol market has remained relatively stable for several years at approximately 300 million gallons annually. Almost all of this volume has been produced synthetically from petroleum raw materials (gas and oil). These raw materials are experiencing major price increases and are in short supply. The production of ethyl alcohol from cereal grains and cellulosic raw materials by fermentation is technically and operationally feasible. Alcohol produced from all such materials is equal to synthetic alcohol in quality and performance. Competitive economics control the basic raw materials used.

- 3830 • Potamogetonin, a New Furanoid Diterpene. Structural Assignment by Carbon-13 and Proton Magnetic Resonance
Cecil R. Smith, Jr., Richard V. Madrigal, David Weisleder, Kenneth L. Mikolajczak, and Robert J. Highet¹
(¹National Heart and Lung Institute, Bethesda, Md.)
J. Org. Chem. 41(4): 593-596. February 1976

Potamogetonin (1), a new furanoid diterpene with a labdane skeleton, has been isolated from seeds of *Potamogeton ferrugineus* Hagstr. The structure of 1 has been assigned on the basis of its spectral characteristics, particularly by nuclear magnetic resonance. The proton and carbon-13 chemical shifts of two related diterpenes of known structure, sciadin (3) and nepeataefuran (4), are correlated with shifts of 1.

- 3831 • Co-Identity of the Refusal and Emetic Principle from *Fusarium*-Infected Corn
R. F. Vesonder, A. Ciegler, A. H. Jensen,¹ W. K. Rohwedder, and D. Weisleder
(¹University of Illinois, Urbana)
Appl. Environ. Microbiol. 31(2): 280-285. February 1976

The structure of vomitoxin isolated from *Fusarium*-contaminated corn was proved to be 3,7,15-trihydroxy-12,13-epoxytrichothec-9-en-8-one. This same toxin is responsible for the refusal phenomenon exhibited by swine fed contaminated corn. In addition, two new substances believed to be trichothecenes were isolated from naturally infected corn. Vomitoxin was also isolated from rice inoculated with *F. graminearum* NRRL 5883.

- 3832 • Photoproduction of Molecular Hydrogen by a Plant-Algal Symbiotic System
J. W. Newton
Science 191: 559-561. February 1976

Azolla plants grown on nitrate were found to photoproduce more hydrogen than plants grown under nitrogen-fixing conditions.

- 3833 • Effects of Maturity and Plant Spacing on the Morphine Content of Two Varieties of *Papaver somniferum* L.
H. L. Tookey, G. F. Spencer, M. D. Grove, and J. A. Duke¹
(¹Beltsville Agricultural Research Center, ARS, USDA, Beltsville, Md.)
Bull. Narc. 27(4): 49-57. October-December 1975

Two varieties of opium poppy were grown under irrigation for one season and their capsules analyzed for morphine content by gas chromatography. Harvest of the capsules at 29-33 days after flowering (mature seed) gave 6.70 kg./ha. morphine as compared to 5.36 kg./ha. morphine in capsules harvested at 4-6 days after flowering. With constant row spacing (30 cm. between double rows on ridges 102 cm. apart), a plant spacing of 6 cm. gave 20% more morphine than either 12- or 18-cm. spacing. There was no statistical differences in morphine content between a blue- and a white-seeded variety.

- 3834* • Occurrence of *Candida parapsilosis*, *C. tropicalis*, and *Saccharomyces cerevisiae* in Pozol from Tabasco, Mexico
Miguel Ulloa¹ and C. P. Kurtzman
(¹Instituto de Biologia, Universidad Nacional Autonoma de Mexico, Mexico, D.F.)
Bol. Soc. Mex. Mic. 9: 7-12. 1975

The potentially pathogenic yeasts *Candida parapsilosis* and *C. tropicalis*, as well as *Saccharomyces cerevisiae*, have been isolated from pozol (from Tabasco, Mexico), a beverage of Mayan origin prepared from fermented maize dough used as a staple food in southeastern Mexico,

- 3835 • Patulin Inhibition of Mycovirus Replication in *Penicillium stoloniferum*
R. W. Detroy and P. E. Still
J. Gen. Microbiol. 92(Pt. 1): 167-174, January 1976

Penicillium stoloniferum NRRL 5267 contains two electrophoretically distinct viruses (PsV-F and PsV-S). An *in vivo* system was developed to test whether a number of fungal metabolites had antiviral properties of PsV-F replication in *P. stoloniferum*. Preliminary results indicated that the mycotoxin patulin can block mycovirus replication. Portions of 48-hour mycelium were incubated in the presence of varying levels of patulin, and after an additional 48 hours incubation, PsV-F content was measured in E₂₆₀ units by polyacrylamide gel electrophoresis. Patulin at 11, 16, and 20 µg./mg. dry wt. mycelia blocked PsV-F replication 26, 61, and 71%, respectively, compared with untreated controls. At these levels, host biomass ribonucleic acid and protein synthesis were minimally affected. Non-proliferating fungal mycelium is capable of continued support of PsV-F replication, which is sensitive to patulin. Apparently, inhibitory doses of patulin stimulated PsV-S replication during this 48-hour incubation. The preferential action of patulin may arise from metabolite binding to functional enzymes required for virus replication.

- 3836 • Maximizing Feed Benefits from Byproducts of Corn Dry Milling
J. S. Wall
Feed Ind. Rev. 52(1): 12-17. First Quarter 1976

For many years, the dry-mill processing of corn was fairly uniform throughout the industry, and hominy feed conformed to established standards of minimum and maximum composition. However, growing interest in the components of hominy feed has encouraged new directions in its processing. As a result, some companies currently offer hominy feeds that differ somewhat from the standards. We examine what these changes in composition mean in terms of feed value and how hominy feed constituents may be most effectively used for maximum profitable returns.

- 3837 • Controlling Particle Size and Structure of Starch Xanthide in Elastomer Masterbatches
R. A. Buchanan, H. L. Seckinger, W. F. Kwolek, W. M. Doane, and C. R. Russell
J. Elastomers Plast, 8(1): 82-95. January 1976

Simple manipulation of conditions during coprecipitation of starch xanthide with elastomer makes it easy to tailor masterbatches for specific end uses. The size and shape of starch xanthide particles, as determined by electron microscopy, were correlated with masterbatch and vulcanizate properties. Starch xanthide of about the same average particle diameter as N765 (SRF-HS) black gave similar tensile strengths but much higher moduli than this high-structure carbon black. Starch xanthides of larger particle sizes comparable to fine- or medium-thermal blacks also gave equal or better tensile strengths and much higher moduli than these blacks. Starch xanthide-elastomer masterbatches not only are versatile compounding materials, but also provide processing advantages and vulcanizate properties usually obtained only from high-structure carbon blacks.

- 3838 • Alcohols from Ozonolysis Products of Unsaturated Fatty Esters
E. H. Pryde, C. M. Thierfelder, and J. C. Cowan
J. Am. Oil Chem. Soc. 53(3): 90-93. March 1976

1-Nonanol and alkyl 9-hydroxynonanoates were more readily prepared by hydrogenation of the respective isolated aldehydes than by direct hydrogenation of products from reductive ozonolysis of oleate esters. Hydrogenation with nickel catalysts and aprotic solvents reduced the isolated aldehydes in good yield with a minimum of side reactions. Although the noble metal catalyst and hydroxylic solvent systems frequently used in similar reductions were also effective, they required a promoter that fortuitously catalyzed hydrolysis of acetals that formed during hydrogenation. Direct hydrogenation of the ozonolysis products resulted in side reactions and a mixture of products difficult to separate.

3839 • Fatty Acid Composition as a Basis for Identification of Commercial Fats and Oils

G. F. Spencer, S. F. Herb,¹ and P. J. Gormisky²

(¹Eastern Regional Research Center, ARS, USDA, Wyndmoor, Pa.;

²Pennsylvania State University, University Park, Pa.)

J. Am. Oil Chem. Soc. 53(3): 94-96. March 1976

Gas-liquid chromatographic analyses of 200 samples of commercial fats and oils were compared to the standard ranges specified by the Food and Agriculture Organization/World Health Organization Codex Alimentarius Committee on Fats and Oils at its seventh session, London, England, March 25, 1974. Only six samples fell notably outside the standard ranges. On the basis of this information, the U.S. delegation is offering for consideration by the Committee at its next meeting a method for using the fatty acid composition of a fat or oil to determine its authenticity.

3840 • Chick Edema Factor: Removal from Soybean Oil

T. L. Mounts, H. J. Dutton, C. D. Evans, and J. C. Cowan

J. Am. Oil Chem. Soc. 53(3): 105-107. March 1976

Procedures to remove 2,3,7,8-tetrachlorodibenzodioxin, a potent chick edema factor, have been evaluated in laboratory simulations of commercial deodorization, hydrogenation, and bleaching. Soybean oil samples with 1-5 p.p.m. concentrations of added 2,3,7,8-tetrachlorodibenzodioxin-¹⁴C were assayed by liquid scintillation counting before and after processing treatments. Standard conditions of deodorizing were ineffective for removal of 2,3,7,8-tetrachlorodibenzodioxin; extreme conditions (300° C.; 10 hours) reduced the concentration appreciably. Although hydrogenating the oil before deodorization improved 2,3,7,8-tetrachlorodibenzodioxin removal under standard conditions, the level of residue was still greater than acceptable. Treating the oil with activated bleaching clay according to the American Oil Chemists' Society standard method was totally ineffective for 2,3,7,8-tetrachlorodibenzodioxin removal. Substituting either of two different activated carbons in the same procedure removed this contaminant from soybean oil.

3841 • Facile Synthesis of 1,2-*trans*-O-Acetyl Glycosyl Chloride Derivatives of Cellobiose, Lactose, and D-Glucose

William E. Dick and David Weisleder

Carbohydr. Res. 46(2): 173-182. February 1976

Solutions of O-acetyl- α -glycosyl bromide derivatives of D-glucose, cellobiose, and lactose in hexamethylphosphoramide were converted into corresponding β -chlorides at room temperature by the action of lithium chloride. At 3:1 mM ratios of chloride ion to glycosyl, 5-10% w/v solutions of glycosyl bromide formed α - and β -chlorides in ratios equal to or greater than 5:95

within 2-13 minutes and produced crystalline β -chlorides in 70-80% yields. Anomeric compositions were determined by nuclear magnetic resonance spectroscopy in hexamethylphosphoramide. Older methods of preparing 1,2-*trans*-*O*-acetyl glycosyl chlorides, with aluminum chloride or titanium tetrachloride, formed the α - and β -cellobiosyl and -lactosyl chlorides in ratios that varied from 2:3 to 1:4 and reached 85-95% levels of β -chloride only with β -D-glucose pentaacetate. When hydrolyzed under conditions that controlled solution acidity, the β -cellobiosyl and -lactosyl chlorides each formed 2-hydroxy derivatives in yields that could be varied from 16 to 60%. Hepta-*O*-acetyl-2-*O*-methyl- α -cellobiose was prepared to demonstrate how these hydrolysis mixtures can be used to synthesize a 2-*O*-substituted derivative.

- 3842 • A Synthesis of Methyl 4,6-Di-*O*-Methyl- α -D-Mannopyranoside
 Fred R. Seymour, Morey E. Slodki, Ronald D. Plattner,
 and Larry W. Tjarks
 Carbohydr. Res. 46(2): 189-193. February 1976

A new route is described for preparing methyl 4,6-di-*O*-methyl- α -D-mannopyranoside (5) *via* methyl 2,3-di-*O*-*p*-tolylsulfonyl- α -D-mannopyranoside (3) as an intermediate. The retention of the mannopyranoside configuration and ring form was confirmed by proton nuclear magnetic resonance spectroscopy and by mass spectroscopy of peracetylated aldononitrile derivatives. Mass-spectral fragmentation-pathways previously proposed were confirmed for 5-*O*-acetyl-2,3,4,6-tetra-*O*-methyl-, 2,5-di-*O*-acetyl-3,4,6-tri-*O*-methyl-, and 3,5-di-*O*-acetyl-2,4,6-tri-*O*-methyl-D-mannonitrile.

- 3843 • An Extracellular Fungal Polysaccharide Composed of
 2-Acetamido-2-Deoxy-D-Glucuronic Acid Residues
 Paul R. Watson, Paul A. Sandford, Kermit A. Burton,
 Martin C. Cadmus, and Allene Jeanes
 Carbohydr. Res. 46(2): 259-265. February 1976

The black yeast-like fungus NRRL YB-4163, now tentatively identified as *Rhinocladiella elatior* Mangenot, has been found to produce an extracellular microbial polysaccharide composed mainly of 2-acetamido-2-deoxy-D-glucuronic acid residues. Polysaccharide (PS) YB-4163, when isolated in good yield as the neutral potassium salt, dissolves readily in water to produce extremely viscous solutions, which form stable foams and emulsions. By depolymerizing PS YB-4163 with [^{14}C]methanol-HCl, the polysaccharide can be both identified and quantitated radiochemically by determining the individual [^{14}C]methyl glycosides after their separation by paper chromatography. When the methyl glycosides of PS YB-4163 were reduced with NaB^3H_4 , only the methyl glycosides of 2-acetamido-2-deoxy-D-[6- ^3H]glucose were found. Analysis of the monosaccharide released from carboxyl-reduced PS YB-4163 by acid hydrolysis or methanolysis also showed 2-acetamido-2-deoxy-D-glucuronic acid to be the

main constituent. Previously, the only polysaccharides known to be composed entirely of hexosaminuronic acid have been cellular products from pathogens. Of these, the antigenic polysaccharide (SPSA) from *Staphylococcus aureus* is composed entirely of 2-amino-2-deoxy-D-glucuronic acid, but its amino groups are substituted equally with acetyl and *N*-acetylalanyl groups. The specific optical rotation of PS YB-4163, $[\alpha]_D^{20} -75^\circ$ (*c* 0.5, water), is similar to that of SPSA (-91°), and suggests β -D-linkages that must be either (1 \rightarrow 3) or (1 \rightarrow 4).

3844 • Bacterial Membrane Transport of β -Exotoxin, an Antimetabolite of RNA Synthesis

Donovan E. Johnson

Nature 260(5549): 333-335. March 1976

β -Exotoxin, produced extracellularly by certain strains of *Bacillus thuringiensis* during the stationary growth phase, apparently results from nucleic acid metabolism. This monophosphorylated adenine nucleoside derivative can modify ribonucleic acid (RNA) polymerase activity of mammalian and bacterial origin *in vitro* through substrate competitive inhibition. RNA synthesis can be inhibited *in vivo* by injection of β -exotoxin directly into mammalian tissue.

Because β -exotoxin is not actively transported across biological membranes, its use as an inhibitor of RNA synthesis may be limited. Even with appropriate membrane permeabilization, radioactive β -exotoxin was not taken up by exponential cells of *Escherichia coli* and *Bacillus subtilis*. Extracellular unlabeled β -exotoxin did inhibit *in vivo* RNA synthesis in both organisms, but only when cultures were pretreated by a combined EDTA pH shift. Radioactive uridine uptake by both organisms was sensitive to extracellular β -exotoxin. However, inhibition of intracellular RNA synthesis could not be justified on the basis either of β -exotoxin interference of uridine uptake or of any subsequent alterations that may occur in the internal ribonucleotide precursor pools.

3845 • *Aspergillus flavus* Infection and Aflatoxin Production in Mixtures of High-Moisture and Dry Maize

E. B. Lillehoj, D. I. Fennell, and C. W. Hesselstine

J. Stored Prod. Res. 12(1): 11-18. March 1976

High-moisture (26.6-27.9% moisture content) and dry (9.8% moisture content) fractions of white and yellow maize were examined for fungal development and aflatoxin production during an 8-week incubation at 25° C. Treatment procedures included blending of either high-moisture white with dry yellow or high-moisture yellow with dry white maize fractions (average moisture in blend, 14%) and inoculation of some test maizes with *A. flavus* spores. At

sampling time white and yellow components of maize blends were manually separated and all of the maize samples were analyzed for levels of moisture, fungal infection, and aflatoxin. Moisture levels in maize blends equilibrated rapidly during the initial 2-4 days of incubation; neither dry yellow nor dry white exceeded 13% moisture during the trial period. Only a limited incidence of *A. flavus* was observed on uninoculated maize, but in samples treated with *A. flavus* spores a high infection rate developed; from 58 to 98% of the kernels in dry fractions of inoculated blends were infected with *A. flavus* during the trial. Aflatoxin was detected in high-moisture maize and in both high-moisture and dry fractions of inoculated maize blends. Up to 500 µg aflatoxin B₁/kg of corn was found after the 8-week incubation in a dry fraction of inoculated maize blends.

3846 • Oxidation of Methyl Formylstearate with Molecular Oxygen

J. P. Friedrich

J. Am. Oil Chem. Soc. 53(4): 125-129. April 1976

Methyl formylstearate, containing soluble rhodium complex from rhodium-catalyzed hydroformylation of methyl oleate, is oxidized in an emulsion to methyl carboxystearate. The reaction is carried out in a closed system at 20-25° C. in the presence of either air or oxygen (1-3 atmosphere). Conversion to methyl carboxystearate is 87-89% in 2 to 3 hours; when catalytic amounts of calcium acetate are present, 93-95% is converted. The principal byproduct of oxidation is methyl formoxystearate, formation of which is suppressed by calcium acetate. Distillation of crude methyl carboxystearate yields a residue containing soluble rhodium (and calcium acetate if used), which after calcining in the presence of a refractory support produces an effective hydroformylation catalyst. Recovery and regeneration of this catalyst provide an economically feasible batch process for methyl carboxystearate.

3847 • Catalytic Hydroformylation of Unsaturated Fatty Derivatives with Cobalt Carbonyl

E. N. Frankel

J. Am. Oil Chem. Soc. 53(4): 138-141. April 1976

Two cobalt-carbonyl oxo processes were developed to prepare useful products in high yield from fatty derivatives. In one process, hydroformylation in the presence of MeOH at 120° C. gives dimethyl acetal esters from either methyl oleate or oleic acid. In the other, a two-step process, hydroformylation (120° C.) followed by hydrogenation (180° C.) gives better yields of hydroxymethyl esters from both mono- and polyunsaturated fatty substrates. Recycling the cobalt catalyst was demonstrated for the second process. The acetal and acetoxymethyl derivatives of the oxo products have utility as polyvinyl chloride plasticizers.

- 3848 • Acetoxylglycerol Acetal Derivatives of Mono- and Polyformyl-octadecanoate Esters: Plasticizers for Poly(Vinyl Chloride)
W. E. Neff, E. N. Frankel, E. H. Pryde, and G. R. Riser¹
(¹Eastern Regional Research Center, ARS, USDA, Philadelphia, Pa.)
J. Am. Oil Chem. Soc. 53(4): 152-156. April 1976

Methyl and butyl(acetoxylglycerol acetal) esters were prepared from 9(10)-formyloctadecanoate or its dimethyl acetal. Mixtures of acetoxyl mono- and diglycerol acetals, plus acetoxyl mono-, di-, and triglycerol acetals, were prepared respectively from hydroformylated safflower and linseed methyl esters. The glycerol acetals were characterized with respect to physical, thermal, chromatographic, and spectroscopic properties. Acetoxyl-mixed glycerol acetals from safflower and linseed methyl esters were good primary plasticizers for poly(vinyl chloride) (PVC), whereas acetoxylglycerol acetals of hydroformylated methyl and butyl oleate were good secondary PVC plasticizers. As primary plasticizers, the poly(acetoxylglycerol acetal) esters showed less migration, better heat stability, and higher tensile strength than the generally used PVC plasticizer di(2-ethylhexyl) phthalate.

- 3849 • Fractionation and Quantitative Differences of Glutenin from Wheat Varieties Varying in Baking Quality
F. R. Huebner and J. S. Wall
Cereal Chem. 53(2): 258-269. March-April 1976

Properties of glutenin and other wheat proteins were investigated that may be responsible for varietal differences in wheat flour performance. The proteins from several wheat flours differing in mixing times and dough strengths were extracted with a solution of 0.1 *N* acetic acid, 3 *M* urea, and 0.01 *N* hexadecyltrimethylammonium bromide buffer. After dialysis and lyophilization, the extract was dissolved in 5.5 *M* guanidine hydrochloride and passed through an agarose gel filtration column. The glutenin protein was separated into two fractions: (I) a high-molecular-weight fraction eluting at the void volume and (II) some lower molecular weight proteins eluting as a broad peak. Next, the gliadins and water-soluble proteins were eluted in close sequence. Glutenins I and II differed only slightly in amino acid analysis and gel electrophoresis patterns of their subunits. However, the elution profiles (from the 4% agarose columns) of the extracts from the various wheats differed significantly, especially in the glutenin region. The ratio of glutenin I to glutenin II was generally higher in bread wheat flours exhibiting long mixing times and strong doughs. In accordance with observations by Orth and Bushuk, these flours also contained the highest amount of unextracted protein. Flours of weak dough wheats generally had lesser contents of both glutenin I and unextracted protein. A sufficient total amount of protein and suitable proportions of the two glutenin fractions and the insoluble fraction are necessary for a good baking flour.

- 3850 • Publications and Patents of the Northern Regional Research Laboratory, July-December 1975
North. Reg. Res. Lab., ARS, USDA, 58 pp. [April 1976]
- 3851 • Alpha-Galactosidase Production and Use in a Hollow-Fiber Reactor
K. L. Smiley, D. E. Hensley, and H. J. Gasdorf
Appl. Environ. Microbiol. 31(4): 615-617. April 1976

Soybean milk serves as a base for a variety of beverages designed for consumption in developing countries. Soybean flour contains raffinose and stachyose considered to be responsible for flatulence often associated with these products. Alpha-galactosidase, produced economically on wheat bran, hydrolyzes the troublesome galactooligosaccharides of soybean milk.

- 3852* • Corn Starch: Present and Potential Uses in Industry
Charles R. Russell
Corn Annual (Corn Refiners Association, Inc.), pp. 26-29. 1976

Domestic consumption of corn starch products, including unmodified and modified starches, in industrial or nonfood applications, amounts to approximately 3 billion pounds annually. About 90% of the present usage is accounted for by products employed as wet-end additives, sizing agents, and adhesives in making and coating paper and paperboard; as adhesives in producing boxboard, insulation board, paper bags, and cardboard cartons, as well as gummed labels and tapes; and as sizes in the manufacture of textiles. These applications are reviewed briefly with emphasis on the types of starch products involved and their function(s) in each application. Also discussed are a number of recent advances at this Laboratory in applied research on starch that appear to have excellent potential for increasing utilization of starch, sparing petrochemical products, saving energy, and providing ecologically oriented materials.

- 3853* • Annual Crops--A Renewable Source for Cellulose
Dwight L. Miller
Appl. Polym. Symp. No. 28: 21-28. 1975

Historically, cellulosic materials from annual crops have been of major industrial importance. They predate wood for paper by centuries. As early as 500 B.C., pressed sheets were made in Egypt from papyrus. The technique of papermaking, most closely related to processing now followed, was based primarily on cellulose from such annual crops as cotton, flax, and hemp. Commercially, cellulose is available from annual fiber crops, byproducts, and residues. Typical fiber crops are kenaf, jute, reeds, hemp, cotton,

and esparto grass. They may be grown under either cultivated or natural conditions. Byproducts include cereal straws, sugarcane bagasse, oilseed stalks, and similar cellulosic materials normally associated with a principal agricultural crop. Residues represent many different types of materials and are best typified by food and animal wastes. Annual crops have increasing potential as renewable raw materials to meet future requirements for cellulose and cellulose-based chemicals.

- 3854 • Protein Concentrate from Normal and High-Lysine Corns
by Alkaline Extraction: Preparation
Y. Victor Wu and Kenneth R. Sexson
J. Food Sci. 41(3): 509-511. May-June 1976

An alkaline extraction process was developed to produce protein concentrates and starch from ground normal and high-lysine corns. Optimum extraction of protein occurred at pH 11.7 in 0.1 *N* sodium hydroxide with 150 grams per 900 ml. solvent. The corn was extracted twice with sodium hydroxide solutions. After centrifugation, each alkaline extract was adjusted to pH 4.7 to recover the protein as a precipitate. Bran was removed from starch and protein by screening the second alkaline dispersion, and the protein and starch were separated by centrifugation. The protein content (nitrogen x 6.25) of the concentrate varied between 63 and 71% and accounted for 52-63% of the total corn protein. High-lysine corn yielded more concentrate than normal corn, as well as more starch.

- 3855 • Protein Concentrate from Normal and High-Lysine Corns
by Alkaline Extraction: Composition and Properties
Y. Victor Wu and K. R. Sexson
J. Food Sci. 41(3): 512-515. May-June 1976

Protein concentrates and byproducts produced by alkaline extraction from ground corn having normal and high contents of lysine were analyzed for amino acid composition, protein, starch, fat, ash, fiber, and various neutral carbohydrates. A high-lysine concentrate contained 65% protein (nitrogen x 6.25) with a 4.7 gram lysine and 4.0 gram total sulfur amino acids per 16 grams nitrogen recovered. The minimum nitrogen solubility of the concentrates was 3-5% near pH 5.5. The protein concentrates have good functionality relative to their emulsifying activity, emulsion stability, and hydration capacity.

- 3856 • Toasting and Hexane:Ethanol Extraction of Defatted Soy Flakes.
 Flavor of Flours, Concentrates and Isolates
 D. H. Honig, K. Warner, and J. J. Rackis
 J. Food Sci. 41(3): 642-646. May-June 1976

Flours and protein concentrates, prepared from defatted soybean flakes steamed up to 20 minutes before or after extraction with hexane:ethanol azeotrope 82/18 v/v, were presented to a 15-member trained taste panel. Flavors and odors were described and rated for intensity on a scale of 1 to 10 where 1 is strong and 10 is bland. Azeotropic extraction for 6 hours by itself significantly affected flavor of flours and of concentrates so that they scored 7.4 and 6.8, respectively, compared to 4.0 for raw, hexane-defatted, soy flour. Toasting after azeotropic extraction raised flavor scores of flours and protein concentrates to 7.9, a value which compares favorably with 8.1 for wheat flour. Toasting is also necessary to inactivate trypsin inhibitors and other antinutritional factors in azeotropic-extracted soybean flakes. A protein isolate from toasted, azeotropic-extracted flakes scored 7.3 compared to 8.0 for sodium caseinate. Yields of isolates are good if the heat-processed flakes are extracted with hot water at 74° C. and pH 7.2.

- 3857 • Protein Electrophoresis Aids in Wheat Breeding
 J. A. Bietz
 Proc. 9th Nat. Conf. Wheat Util. Res., held at Seattle, Washington, October 8-10, 1975, U.S. Agric. Res. Serv., ARS-NC-40, pp. 61-75.
 February-March 1976

Protein analysis by electrophoresis can be extremely useful to the wheat breeder. For example, glutenin subunits from single wheat kernels may be analyzed by SDS electrophoresis; these techniques are highly specific, reproducible, and rapid and are particularly applicable to early generation screening and selection. Other wheat protein classes may also be analyzed and compared by other electrophoretic techniques. The breeder can use protein electrophoresis to detect variability through screening, to look for mutation or variability within a variety, and to relate specific marker proteins to specific characteristics, properties, or possibly to quality. The wheat geneticist also can use these techniques to study evolutionary relationships among related species or between varieties. Protein electrophoresis should become a valuable addition to all other methods of selection and analysis used by wheat breeders and geneticists.

- 3858 • Cereal Starch and Flour Products as Substitutes and Extenders for Petroleum-Based Polymers and Plastics
C. R. Russell
Proc. 9th Nat. Conf. Wheat Util. Res., held at Seattle, Washington, October 8-10, 1975, U.S. Agric. Res. Serv., ARS-NC-40, pp. 122-134. February-March 1976

Recent, as well as projected, price increases and shortages of petroleum and natural gas have intensified interest in using annually renewable raw materials to develop substitutes and extenders for synthetic polymers and plastics. During the past several years a number of cereal-based products have been developed, mostly through research at the Northern Laboratory, which have good potential for satisfying some of these pressing needs. The new cereal products include polyols for making foamed insulating material and protective coatings; biodegradable fillers for plastics; reinforcing fillers for rubber; and graft polymers of starch for flocculating, thickening, and water-holding applications.

- 3859* • Methyl α -Maltoside
W. E. Dick, Jr. and J. E. Hodge
Methods Carbohydr. Chem. 7: 15-18. 1976

A mixture of methanol, bromine, and silver carbonate smoothly converted ethyl 1-thio- β -maltoside into a mixture containing methyl α,β -maltoside. The α -anomer, which initially formed 85% of the maltoside fraction, was enriched by selective oxidation of the β -anomer with chromic acid. Chromatographic purification gave a 65% yield of methyl α -maltoside.

- 3860* • Thio Sugars from Oxidatively Coupled Xanthates
B. S. Shasha, D. Trimmell, E. I. Stout, and W. M. Doane
Methods Carbohydr. Chem. 7: 36-41. 1976

Oxidatively coupled sugar xanthates, known as dithiobis(thioformates), decompose to thio sugars containing *O,S*-dithiocarbonate groups. Thiolation occurs at either primary or secondary carbons in the sugars with retention or inversion of configuration. The choice of decomposition conditions depends upon the structure of the oxidatively coupled xanthate and the minimization of alternate decomposition products such as thionocarbonates. Cyclic dithiobis(thioformates) derived from vicinal *trans*-diols decompose upon pyrolysis or upon treatment with methyl sulfoxide containing catalytic amounts of base to give cyclic *O,S*-dithiocarbonates with accompanying inversion at the site of thiolation. Decomposition is greatly facilitated when a primary carbon atom is included in the dithiobis(thioformate) ring or when the ring is attached to positions of an acyclic sugar.

3861* • Thio Sugars from Cyclic Thionocarbonates

D. Trimnell and W. M. Doane

Methods Carbohydr. Chem. 7: 42-43. 1976

Cyclic thionocarbonate esters, which include a primary carbon atom of a sugar, undergo isomerization to cyclic monothiolcarbonates in the presence of potassium iodide in acetonitrile. Thiolation occurs at the primary carbon, and yields of the thio sugar derivatives are 50-85%.

3862 • In Vivo Metabolism of Labeled Oleic and Linoleic Acids by the Laying Hen

T. L. Mounts and H. J. Dutton

Biochim. Biophys. Acta 431(1): 9-15. April 1976

Radioactive oleic and linoleic acids, labeled with tritium in the chain and carbon 14 in the carboxyl group, were administered to white leghorn laying hens. Mixtures fed in separate experiments included: ^3H - and ^{14}C -labeled oleic acid, ^3H - and ^{14}C -labeled linoleic acid, and oleic acid- ^3H and linoleic acid- ^{14}C . The $^3\text{H}/^{14}\text{C}$ ratios both of neutral lipid and phospholipid fractions from egg yolk and of isolated acids from these lipid fractions were compared to those in the administered mixture. Agreement in the $^3\text{H}/^{14}\text{C}$ ratios for the neutral lipid fraction from each of the feeding experiments indicated that the hen did not distinguish between ^3H - and ^{14}C -labeled acids nor oleic or linoleic acids during synthesis of the neutral lipid.

Analysis of the phospholipid fractions showed that when dual-labeled mixtures of oleic acid were administered, $^3\text{H}/^{14}\text{C}$ ratios were elevated, and therefore, there was selective elimination of the ^{14}C -label. When dual-labeled mixtures of linoleic acid were administered, the $^3\text{H}/^{14}\text{C}$ ratios were in agreement; and when the two acids were administered simultaneously as a dual-labeled mixture, there was selective incorporation of linoleic acid.

These findings indicate separate metabolic pathways for synthesis of neutral lipid and phospholipid in egg yolk as expected, as well as preferential use of the essential fatty acid in the phospholipid by the hen.

3863 • Production of Fungal Spores as Inocula for Oriental Fermented Foods

C. W. Hesseltine, E. W. Swain, and H. L. Wang

Dev. Ind. Microbiol. 17: 101-115. 1976

Mass production of fungal spores as inoculum for a substrate is an important aspect in making fermented foods. Desirable inoculum characteristics include: (1) production of spores in large quantities; (2) uniform viability and genetic stability over a period of several months; (3) high percentage

of spore germination in a short time; (4) correct proportion of strains when mixed strains are used; (5) ready dispersibility of spores in fermentation substrate; and (6) freedom from contaminating organisms. There are various methods for preparing inocula for mold cheese, koji, tempeh, and other fermented food products using fungi belonging to the genera *Aspergillus*, *Neurospora*, *Actinomucor*, *Rhizopus*, *Monascus*, *Penicillium*, and *Mucor*. Common substrates for spore production are rice, bread cubes, wheat, and wheat bran. Inoculum may be stored in a dry state at temperatures above freezing, in a dry state in liquid nitrogen, and as freeze-dried spores. The storage state is important to ensure, as nearly as possible, 100% viability. In some instances, trace elements are added to the sporulation substrate to improve inoculum vigor.

3864* • Carbohydrates

J. E. Hodge and Elizabeth M. Osman¹

(¹University of Iowa, Iowa City)

In "Principles of Food Science. Part 1. Food Chemistry,"
ed. Owen R. Fennema, chap. 3, pp. 41-138. New York. 1976

The need for acceptable and stable processed foods is increasing as the world population increases. As food supplies and reserves diminish per capita, the importance of abundant carbohydrates increases. Food scientists should soon find economical ways to convert nonnutritive carbohydrates, particularly cellulose and cellulosic wastes, to nutrients. When this becomes possible, then sugars derived by hydrolysis of nonnutritive polysaccharides can provide suitable substrates for microbial syntheses of nutritive proteins.

Several different types of carbohydrates are now known to be useful in prolonging the storage life of foods and in increasing the acceptability of processed foods. Doubtless more efficient types can be found through study of the interactions of carbohydrates with essential proteins, lipids, and minerals. However, the stability of dehydrated foods is limited by non-enzymic browning reactions of reducing sugars with amino acids and proteins. Development of improved methods for avoiding or inhibiting these chemical reactions in dehydrated and canned foods should permit a significant increase in reserve food supplies.

3865* • Mycotoxins in Animal Feeds: The Extent and Nature of the Problem

Alex Ciegler

Feedstuffs 48(17): 18-19. April 1976

Aflatoxin appears to present a problem to the feed industry primarily in southeastern states, where a high percentage of the corn may be contaminated.

Zearalenone and the trichothecenes cause sporadic problems in the Midwest, but extensive survey data are not available to delineate the situation more accurately. Sufficient research has not been conducted on other mycotoxins to permit a definitive statement.

3866 • Starch Breads Textured with Xanthan Gum

[D. D. Christianson]

North. Reg. Res. Center, U.S. Agric. Res. Serv., CA-NRRC-44,
2 pp. June 1976 [Processed]

A breadmaking process has been developed at the Northern Regional Research Center which incorporates xanthan gum as a gluten replacement. Doughs and batters for dietetic, specialty, and fast breads can be made from a wide variety of starches and soy protein with the gum (food grade) serving as a foamed matrix.

3867* • Soybeans

J. C. Cowan and W. J. Wolf

In "Encyclopedia of Food Technology," eds. Arnold H. Johnson and Martin S. Peterson, pp. 818-828. Westport, Conn. 1974

A concise review of the use of soybeans, soybean oil, lecithin, flour, protein concentrates, and isolates for food.

3868* • Chemistry and Technology of Soybeans

W. J. Wolf

Adv. Cereal Sci. Technol. 1: 325-377. 1976

A review of new developments from 1970 to 1975 on soybean production, seed structure, chemical properties of seed constituents, and processing of soybeans into edible oil and protein products. Flavor, functional and nutritional properties of the proteins are also discussed.

3869 • Conditions Leading to Mycotoxin Contamination of Foods and Feeds

C. W. Hesseltine

Adv. Chem. Ser. No. 149: 1-22. 1976

Toxigenic mold invasion is affected during plant growth, at harvest, and after harvest. Invasion by fungi is affected by the amount of spore inoculum in the field, stresses on the plant, invertebrate infections, damage by

other fungi, plant resistance, mechanical damage, mineral nutrition of the plant, and temperature. During harvest, grain is exposed to mechanical damage and mold inoculum. After harvest, mold growth depends on moisture level of the grain, temperature and humidity, rapidity of drying, aeration, the microbiological ecosystem, insects, mixing of grain, chaff and dirt, chemical treatment, internal infection, accidental rewetting of the grain by condensation or leakage, and the development of hot spots.

3870 • Chemical Methods Investigated for Detoxifying Aflatoxins in Foods and Feeds

A. C. Beckwith, R. F. Vesonder, and Alex Ciegler
Adv. Chem. Ser. No. 149: 58-67. 1976

Refined edible vegetable oils are dependably free of aflatoxins because the alkaline washes and bleaching agents used in the oil processing are among the chemical systems that remove or destroy aflatoxin. Currently, ammonia in conjunction with elevated temperatures or pressures, or both, as well as elevated moisture levels offers the best way to detoxify agricultural seed commodities for feed. Research at the Northern Laboratory has shown that ammoniation of contaminated whole corn reduces aflatoxin B₁ to a chemically nondetectable level and that the ammoniation products are nontoxic to ducklings and chickens. Using radio labelled aflatoxin B₁ to spike white corn meals we showed that ammoniation at ambient temperature induces the covalent binding of B₁ or B₁ degradative products primarily to corn proteins and water-soluble components.

3871 • *Helminthosporium*, *Drechslera*, and *Bipolaris* Toxins

Odette L. Shotwell and J. J. Ellis
Adv. Chem. Ser. No. 149: 318-343. 1976

Metabolites produced by *Helminthosporium* and *Drechslera* (*Bipolaris*) species include: pigments--polyhydroxyanthraquinones and polyhydroxyxanthones; antibiotics--ophiobolins, monocerins, siccanin, and helmintin; mycotoxin--sterigmatocystin; phytotoxin--helminthosporal; pathotoxins from *Drechslera carbonum*, *D. victoriae*, *D. maydis*, and *D. sacchari*; and teratogenic compounds--cytochalasins. Almost all these compounds have been shown to be toxic either to animals or plants. Others, such as the polyhydroxyanthraquinones and polyhydroxyxanthones, belong to classes of compounds known to be toxic. With the exception of the pathotoxins, there is little evidence for the natural occurrence of *Helminthosporium* and *Drechslera* toxins. The mycotoxin, sterigmatocystin, has been found in moldy grain collected on a farm in Canada.

3872 • Double Bond Location in Polyenoic Fatty Esters through Partial Oxymercuration

R. D. Plattner, G. F. Spencer, and R. Kleiman
Lipids 11(3): 222-227, March 1976

A rapid micro-procedure has been developed to locate double bonds in fatty acid methyl esters containing from one to four double bonds. Reaction of the ester with an equal molar amount of mercuric acetate in methanol and reduction with sodium borohydride, followed by hydrogenation, produce a mixture of monomethoxy alkanoates. The mass spectrum of this mixture is simpler and more definitive than that from the completely methoxylated polyenoate. Only one methoxyl group is present per molecule, and the mass spectrum of the mixture is indicative of all olefinic positions. Four intense ions are observed for all double bonds examined, except $\Delta 3$, where the double bond is represented by only two ions. Hydrogenation in a gas chromatograph reduces total analysis time to 1 hour.

3873 • Color Development in C_{18} Unsaturated Hydroxyamides

W. J. Schneider and L. E. Gast
J. Am. Oil Chem. Soc. 53(5): 186-189. May 1976

Dark colors both of hydroxyamides produced from unsaturated fatty acids and of alkanolamine compounds in general might possibly limit their industrial applications. While metal salts have long been recognized as probably involved in the problem, little appears in the literature concerning the nature of these colored compounds.

When we prepared linseed and soy *N,N*-bis(2-hydroxyethyl)amides as intermediates for protective coatings, we discovered that metals, iron and copper in particular, formed highly colored products with these unsaturated hydroxyamides. On standing at room temperature, these intermediates became deep reddish brown (18 on the Gardner scale) if only 1 p.p.m. of copper was present. Because purified starting materials--i.e., alkanolamines, methyl esters, or oils--do not color or darken in the presence of copper and air, several structural features and conditions must be present if color is to develop.

While either chelating agents or antioxidants are somewhat effective over a short time, color formation has been successfully retarded during long-term storage of polyunsaturated *N,N*-bis(2-hydroxyethyl)amides by adding 1% potassium borohydride.

- 3874 • Hydroformylation with Recycled Rhodium Catalyst and One-Step Esterification-Acetalation: A Process for Methyl 9(10)-Methoxymethylenestearate from Oleic Acid
R. A. Awl, E. N. Frankel, and E. H. Pryde
J. Am. Oil Chem. Soc. 53(5): 190-195, May 1976

Previous studies on hydroformylation of methyl oleate with rhodium and either triphenylphosphine or triphenylphosphite have led to a laboratory process for recycling the precious metal catalyst. Another catalyst recycling process has now been studied as the basis for converting commercially available oleic acid into the enol ether of methyl formylstearate. The process involves one-step esterification-acetalation of formylstearic acid made by hydroformylating oleic acid with rhodium and triphenylphosphine. Esterification-acetalation is done in a recycling system with methanol, an acid-exchange resin for catalysis, and molecular sieves to remove water from the reaction mixture. The dimethyl acetal methyl ester formed from formylstearic acid is thermally cracked and distilled in one pot to produce the enol ether, methyl methoxymethylenestearate. The soluble rhodium catalyst in the distillation residue is combined with the insoluble catalyst from filtration and recycled for hydroformylation. The product methoxymethylenestearate is a versatile and stable derivative for various potential industrial applications.

- 3875 • Some Esters of Mono-, Di-, and Tricarboxystearic Acid as Plasticizers; Preparation and Evaluation
E. J. Dufek, F. L. Thomas, E. N. Frankel, and G. R. Riser¹
(¹Eastern Regional Research Center, ARS, USDA, Philadelphia, Pa.)
J. Am. Oil Chem. Soc. 53(5): 198-203, May 1976

Methyl mono-, di-, and tricarboxystearates were prepared by either a two-step hydroformylation-oxidation reaction or direct hydrocarboxylation of unsaturated vegetable oil methyl esters. Procedures were developed for preparing alkyl dicarbomethoxy-, dicarboethoxy-, and dicarbobutoxystearates. These triesters, along with some di- and tetraesters from mono- and tri-carboxystearic acids, were evaluated as primary plasticizers for polyvinyl chloride (PVC). Except for butyl carbobutoxystearate, the esters were compatible at the 32% level and had properties equal or superior to those of dioctyl phthalate. Methyl and butyl diesters of carboxystearic acid had undesirable migration and volatility properties. The migration and volatility properties of some tri- and tetraalkyl esters were equal to or better than the controls. Of the various esters tested, methyl dicarbomethoxystearate containing 13 to 49% methyl tricarbomethoxystearate was an efficient plasticizer for PVC at the 32% level.

3876 • Zearalenone: Distribution in Dry-Milled Fractions of Contaminated Corn

G. A. Bennett, A. J. Peplinski, O. L. Brekke, L. K. Jackson, and W. R. Wichser¹

(¹John Stuart Research Laboratories, Quaker Oats Company, Barrington, Ill.)

Cereal Chem. 53(3): 299-307. May-June 1976

Three lots of naturally contaminated yellow corn from the 1972 crop were dry milled to determine the distribution of zearalenone in mill fractions. Two different procedures were used to mill representative samples of the three lots of contaminated corn. Zearalenone and fat contents of each fraction were determined, and their distributions calculated. Dry cleaning of the corn before milling removed from 3 to 10% of the zearalenone. All mill fractions from both procedures were contaminated with zearalenone. The highest levels of contamination were in the hull and high-fat fractions. Prime product mix (grits, low-fat meal, and flour, representing product yields of 57-63%) contained approximately 20% of the zearalenone in the whole corn.

3877 • Glucosinolates and Derived Products in Cruciferous Vegetables. Analysis of the Edible Part from Twenty-Two Varieties of Cabbage

C. H. VanEtten, M. E. Daxenbichler, P. H. Williams,¹ and W. F. Kwolek²

(¹University of Wisconsin, Madison; ²Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)

J. Agric. Food Chem. 24(3): 452-455. May-June 1976

Knowledge of glucosinolate (GS) content in cabbage (*Brassica oleracea*) is needed to establish levels at which these compounds or their enzymically released products are consumed. New methods of analysis for individual and total GS were applied to 12 open-pollinated and 10 hybrid varieties. Total glucosinolates in cabbage as harvested ranged from 299 to 1,288 p.p.m. Of the 12 GS's determined, those found in the greatest amount were: two 3-indolymethyl GS's (18 to 63 p.p.m. as thiocyanate ion); allyl GS [4 to 146 p.p.m. as allyl isothiocyanate (ITC)]; 3-methylsulfinylpropyl GS (30 to 164 p.p.m. as ITC); 4-methylsulfinylbutyl GS (0.2 to 119 p.p.m. as ITC). The last two have not been quantitated previously in edible cabbage. Goitrin content ranged from 1.2 to 26 p.p.m. Significant differences among varieties were found and are attributed to genetic variability. Variation in GS content from head to head within a variety was greater in the open-pollinated than in the hybrid varieties.

3878 • Triticale Protein Concentrate: Preparation, Composition, and Properties

Y. Victor Wu, K. R. Sexson, and J. S. Wall

J. Agric. Food Chem. 24(3): 511-517. May-June 1976

An alkaline extraction process gives protein concentrates and starch from ground triticale. Optimum extraction was at pH 10.8 in 0.05 *N* sodium hydroxide with 150 g. triticale per 900 ml. solvent. The triticale was extracted twice with sodium hydroxide solutions. After centrifugation each of two alkaline extractions was adjusted to pH 4.6 to yield a precipitate and a supernatant. Bran was removed from starch and protein by screening the second alkaline dispersion. Protein content (nitrogen x 5.7) of the concentrates varied between 82 and 87%, depending on the amount in the original grain, accounted for 53 to 59% of total triticale protein, and had from 3.2 to 3.3 g. lysine and 3.5 to 3.8 g. total sulfur amino acids per 16 g. nitrogen. Minimum nitrogen solubility of the concentrates was 8 to 9% near pH 6, and solubility was 70 to 83% at pH 2.3. All protein concentrates had good functionality relative to their hydration capacity (near 4), emulsifying activity (near 90%), and emulsion stability (around 85%).

3879 • Aflatoxin M₁. Occurrence in Stored and Freshly Harvested Corn

Odette L. Shotwell, Marion L. Goulden, and C. W. Hesseltine

J. Agric. Food Chem. 24(3): 683-684. May-June 1976

Aflatoxin M₁ (50 p.p.b.) has been found in a ground blended sample of stored corn collected in Illinois that contained 1,600 p.p.b. aflatoxin B₁. Aflatoxin M₁ was also detected in seven samples of freshly harvested corn from the Southeast containing 210-3,200 p.p.b. B₁. Individual fluorescing corn kernels and pieces were collected from four lots of corn for M₁ analysis: white stored corn, freshly harvested yellow corn, stored yellow corn, and acid-treated stored yellow corn. Aflatoxin M₁ could be detected in kernels and pieces that contained more than 1,000 p.p.b. B₁, and its identity was confirmed by the acetate derivative.

3880* • A Potential Microbiological Assay of Fruit Content in Orange Juice Products

C. E. Vandercook,¹ Dora C. Smolensky,¹ L. K. Nakamura, and Ruth L. Price¹

(¹USDA Fruit & Vegetable Chemistry Lab, ARS, Pasadena, Calif.)

J. Food Sci. 41(3): 709-710. May-June 1976

A microbiological assay has been developed to estimate the content of orange juice in a product. A bacterium was found which under standard assay conditions grew in proportion to the amount of orange juice in the mixture. Imitation orange beverages did not support growth. Commercial concentrates

from various sources were assayed by the microbiological procedure, and the variability of the results was about the same as or slightly lower than that of many of the other constituents used to estimate juice content. Preliminary tests suggest that the organism is a homofermentative *Lactobacillus* of the subgenus *Streptobacterium*.

3881 • Toxicity of the Parasporal Crystal of *Bacillus thuringiensis* to Japanese Beetle Larvae

E. S. Sharpe

J. Invertebr. Pathol. 27(3): 421-422. May 1976

The parasporal crystal (δ -endotoxin) of *Bacillus thuringiensis*, thought to be toxic only to the Lepidopteran order of insects, has been found to be toxic to larvae of the pestiferous Japanese beetle. If the crystal can be protected from soil microflora, a potent new bacterial insecticide for Japanese beetle larvae will be available.

3882 • Cationic Starch Graft-Polychloroprene Latexes

L. A. Gugliemelli, C. L. Swanson, W. M. Doane, and C. R. Russell

J. Polym. Sci., Polym. Lett. Ed. 14(4): 215-218. April 1976

When such reactive monomers as methyl acrylate (MA) and acrylonitrile (AN), which are slightly soluble in water (5-7%), are graft copolymerized onto gelatinized cationic starch possessing tertiary amine groups (TAS) at 25° C. by cerium(IV) initiation, copolymers result that contain up to 60% polyvinyl side-chain grafts. When starch-graft reaction mixtures of TAS-*g*-poly(MA) and TAS-*g*-poly(AN) having up to 8% solids are adjusted to pH 5.5 and are sonified at 20 kHz for 1 to 3 minutes, latexes result that dry at room temperature or 70° C. to clear adhesive films. To our knowledge nothing has been reported on grafting water-insoluble dienes to cationic starch in aqueous systems at room temperature by cerium(IV) initiation. Incorporation of dienes in starch graft copolymers and terpolymers could lead to new starch polymers having curing capabilities and possible utility in a number of industrial areas. We report not only our successful graft polymerization of chloroprene onto gelatinized cationic starch in aqueous media at 25° C. by cerium(IV) initiation, but also the subsequent sonification of the resulting reaction mixtures adjusted to pH 5.5 to form novel low-viscosity latexes. These dried at both room temperature and at 70° C. to clear soft films highly adhesive to glass, wood, and paper.

3883 • Teratogenicity of Patulin and Patulin Adducts Formed with Cysteine

A. Ciegler, A. C. Beckwith, and L. K. Jackson

Appl. Environ. Microbiol. 31(5): 664-667. May 1976

The LD₅₀ of patulin for the chick embryo injected in the air cell before incubation was determined to be 68.7 µg; for the 4-day-old embryo, 2.47 µg. Both patulin (1-2 µg/egg) and the reaction mixture between patulin and cysteine (15-150 µg of patulin equivalents) were teratogenic to the chick embryo. At least two ninhydrin-negative and four ninhydrin-positive products were formed during the latter reaction. Our explanation of the reaction mechanism remains to be elaborated.

3884 • The Genus *Amylomyces*

J. J. Ellis, L. J. Rhodes, and C. W. Hesseltine
Mycologia 68(1): 131-143. January-February 1976

Amylomyces is a monotypic genus containing the somewhat variable species *A. rouxii* Calmette. Certain species of *Chlamydomucor* and Boedijn's species *Rhizopus chlamydosporus* are synonyms. Strains vary from somewhat restricted sterile white colonies to light grey-brown colonies containing many abortive sporangia. All strains produce abundant chlamydospores. During growth in liquid media containing glucose as the carbon source, strains exhaust the glucose within the first 3 days and the lactic acid that is formed is used as a secondary carbon source after a short lag period. The pattern of utilization of sucrose, maltose, and glycerol by strains of *Amylomyces rouxii* and *Rhizopus oryzae* supports the morphological data that make these two genera distinct.

3885 • Separation of Some Perbenzoylated Carbohydrates by High-Performance Liquid Chromatography

J. Lehrfeld
J. Chromatogr. 120(1): 141-147. May 1976

A number of hydroxy and polyhydroxy compounds, monosaccharides, and disaccharides as their perbenzoylated derivatives were separated by high-pressure liquid chromatography (Corasil II). The preparation of these derivatives and several parameters affecting their chromatographic resolutions are discussed.

3886 • Quantitative Gas Chromatography and Gas Chromatography-Mass Spectrometry of *Cephalotaxus* Alkaloids

G. F. Spencer, R. D. Plattner, and R. G. Powell
J. Chromatogr. 120(2): 335-341. May 1976

Plants of the genus *Cephalotaxus* contain many alkaloids, some of which have demonstrated antitumor activity. Analysis of crude alkaloid mixtures by gas chromatography provides quantitation of the active principles and other

nonactive alkaloids. Mass spectrometry was used to identify known alkaloids in extracts and to confirm the presence of previously unknown ones. Such data provide a means for predicting the biological activity of new plant accessions.

3887 • Starch Graft Copolymers--Degradable Fillers for Poly(vinyl chloride) Plastics

F. H. Otey, R. P. Westhoff, and C. R. Russell

Ind. Eng. Chem. Prod. Res. Dev. 15(2): 139-142. June 1976

As part of a continuing program to prepare biodegradable plastics, several starch and dialdehyde starch (DAS) graft copolymers were made, with ceric ammonium nitrate as the initiator, and incorporated as fillers into poly(vinyl chloride) (PVC)-dioctyl phthalate plastic systems. Properties of plastics made with the graft copolymers were compared with those of similar plastics made with unmodified starch. Apparently, grafting improves the compatibility of starch fillers with resins. Of the graft copolymers evaluated, those containing both polyacrylonitrile and polymethyl methacrylate yielded plastics with the highest strength. The DAS graft copolymer plastics had superior strength to those made from starch grafts. When exposed to soil microorganisms, all plastics containing starch grafts supported mold growth; consequently, upon disposal such plastics should degrade more rapidly than conventional PVC plastics.

3888 • Tremorgenic Mycotoxins

Alex Ciegler, R. F. Vesonder, and R. J. Cole¹

(¹National Peanut Research Laboratory, Dawson, Georgia)

Adv. Chem. Ser. No. 149: 163-177. 1976

Ten tremorgenic mycotoxins have been reported in the literature, but structures have been determined for only five of these. The toxins can be separated into three groupings based on their nitrogen content: one, three, or four atoms per molecule. Structural investigations are underway on one of the major unidentified tremorgens, penitrem A; current data indicate the presence of an indole nucleus and an isoprene unit.

3889 • Synergistic Toxic Effects of Citrinin, Ochratoxin A and Penicillic Acid in Mice

G. A. Sansing, E. B. Lillehoj, R. W. Detroy, and M. A. Miller¹

(¹University of Illinois, College of Medicine, Peoria School of Medicine, Peoria, Ill.)

Toxicon 14: 213-220. 1976

The respective LD₅₀'s in mice of citrinin, ochratoxin A, and penicillic acid injected intraperitoneally were 89 mg/kg body weight, 22 mg/kg, and 100 mg/kg. Paired combinations of the mycotoxins--citrinin:ochratoxin A (CI:OA), ochratoxin A:penicillic acid (OA:PA), and penicillic acid:citrinin (PA:CI)--elicited synergistic lethal responses. After administration of citrinin, ¹⁴C-orotic acid incorporation in both liver and kidney increased significantly by 27 hours with a return to control levels at 51 hours. Treatment with penicillic acid also increased orotic acid incorporation into liver ribonucleic acid (RNA) at 27 hours and at 4 hours in the kidney. Ochratoxin A inhibited RNA synthesis in both liver and kidney tissues 6 hours after toxin injection with a subsequent return to control levels at 27 hours. Orotic acid incorporation was inhibited in both kidney and liver 6 hours after treatment with the toxin combination CI:OA. PA:CI stimulated precursor incorporation into kidney RNA at 27 hours and inhibited the function in liver. The OA:PA combination inhibited RNA synthesis in both organs 15-27 hours after toxin treatment.

- 3890 • Determination of Zearalenone in Corn: Collaborative Study
Odette L. Shotwell, Marion L. Goulden, and Glenn A. Bennett
J. Assoc. Off. Anal. Chem 59(3): 666-670, May 1976

Corn samples spiked at levels of 100, 300, 1000, and 2000 µg zearalenone/kg were sent to 22 collaborators for analysis by the Eppley method. All samples were yellow corn except one white corn sample spiked at 2000 µg/kg. Results from 16 collaborators were statistically analyzed. Only 4 of 16 collaborators detected zearalenone in the sample containing 100 µg/kg, but 11 detected the toxin in the sample containing 300 µg/kg. Average recoveries from all samples were 129% at 300 µg/kg, 101% at 1000 µg/kg, and 88% at 2000 µg/kg. The between-laboratory coefficients of variation were 53.0% at 300 µg/kg, 38.2% at 1000 µg/kg, and 27.0% at 2000 µg/kg. Five naturally contaminated corn samples, one in triplicate, were also provided. The mean level of zearalenone in the naturally contaminated samples ranged from 431 to 7622 µg/kg. The mean coefficient of variation for all samples was 40.5%. Two collaborators measured quantities of zearalenone on thin layer chromatographic plates densitometrically. Their results were not included in the statistical analysis, but the results indicated that densitometric measurement, given proper dilutions of solutions, could be used. The method has been adopted as official first action.

- 3891 • Ultraviolet and Infrared Analysis of Rotenone: Effect of Other Rotenoids
Norman E. Delfel
J. Assoc. Off. Anal. Chem. 59(3): 703-707. May 1976

Biases evidenced by past collaborative trials of ultraviolet (UV) and infrared (IR) methods for rotenone can be caused by interference from other rotenoids that occur in extracts of cube and derris. In the UV analysis, sumatrol, rotenolone, and deguelin cause positive errors of decreasing magnitude; elliptone, toxicarol, tephrosin, dehydrodeguelin, and dehydrorotenone produce negative biases of increasing magnitude. In the IR analysis, error depends on rotenoid concentration relative to rotenone concentration. At equal proportions, bias is positive with toxicarol and deguelin and negative with other rotenoids. The baseline version of the IR method has an inherent positive bias of approximately 8% but is superior to the base point version because of greater insensitivity to deguelin. The official first action UV method for the determination of rotenone in derris and cube powder, 6.162-6.163, has been deleted, and the IR method, 6.164-6.165, has been revised to exclude derris products.

3892 • Aflatoxin Occurrence in 1973 Corn at Harvest. II.

Mycological Studies

C. W. Hesseltine, O. L. Shotwell, W. F. Kwolek,¹ E. B. Lillehoj, W. K. Jackson, and R. J. Bothast

(¹Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)

Mycologia 68(2): 341-353, March-April 1976

Since aflatoxin is formed in corn in the field before harvest, our objectives were to determine at harvest (a) the amount of *Aspergillus flavus*-infected corn kernels, (b) the amount of *A. flavus* spores on the surface of corn, (c) the total amount of fungus-infected kernels, (d) the occurrence of *A. flavus* spores in and on insects from corn reported in the first paper of this series, and (e) the correlation between *A. flavus* infection and occurrence of aflatoxin. The corn was collected at harvest from seven counties in northeastern South Carolina and dried to less than 13% moisture as quickly as possible.

Of the 152 aflatoxin-positive samples, 120 showed one or more kernels internally infected with *A. flavus* and of the 145 aflatoxin-negative samples, 59 showed infection. Of the 297 samples examined, 276 had one or more kernels with surface contamination of *A. flavus* spores, and in 75 of the samples every kernel was contaminated. When kernels were surface disinfected, 224 samples (50 kernels each) showed 100% internal mold contamination. One or more kernels of 185 samples were infected with *A. flavus*; this number represents 60% of the total samples. Of the 375 insects collected and examined for *A. flavus* from the corn samples, 247 showed *A. flavus* present. Of the 85 rice weevils, 78 were carrying *A. flavus* spores and of the other 290 insects, 165 were contaminated. Besides *A. flavus*, the predominant infecting fungi internally were two species of *Penicillium* and *Fusarium*. Members of the Mucorales were rarely seen.

- 3893* • Investigation of Ultralow Temperature for Fungal Cultures III. Viability and Growth Rate of Mycelial Cultures Following Cryogenic Storage
Shuh-wei Hwang,¹ W. F. Kwolek,² and W. C. Haynes
(¹American Type Culture Collection, Rockville, Md.; ²Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)
Mycologia 68(2): 377-387, March-April 1976

One hundred and two fungal strains remained viable by cryogenic preservation for 9 years. Two strains survived for only 6 years. Of the two suspending media used, dimethyl sulfoxide was significantly better than glycerol as a cryoprotectant for eight strains. During storage, seven viability checks were performed. Variability was examined in relation to storage time, frozen-thawed cultures vs. first subcultures, mycelial plugs (discs), and vials. Variation in radial growth of colonies was a function of innate properties of an organism, and there was no evidence that variation was influenced by cryogenic conditions (freezing and storage). The proposed method of preservation was demonstrated to be suitable for long-term conservation of these strains and is presumably applicable to other mycelial cultures.

- 3894 • Oat Protein Concentrates for Beverage Fortification
J. E. Cluskey, Y. V. Wu, G. E. Inglett, and J. S. Wall
J. Food Sci. 41(4): 799-804. July-August 1976

Up to 4% oat protein concentrates can fortify either neutral or acidic beverages. The concentrate was produced in good yield from both defatted and non-defatted oat groats by alkaline extraction. If desired, the gum and water-soluble protein fractions can be removed by a preliminary water extraction yielding a concentrate with a higher percentage of protein. Nitrogen solubility of protein concentrate from defatted groats in dilute phosphoric acid was considerably higher than one from nondefatted groats. Fortified acidic beverages (pH 3) prepared with oat concentrate from laboratory ground groats were slightly astringent in taste. However, astringency was eliminated if the concentrate was produced from commercial oat flour (heat treated during production). Milklike and breakfast-type beverages fortified with oat protein concentrate would be nutritious, palatable, and easily prepared and flavored.

- 3895 • L-Serine Dehydratase from *Proteus vulgaris*
G. E. N. Nelson and R. E. Peterson
Dev. Ind. Microbiol. 17: 399-404. 1976

L-Serine dehydratase, proposed as an antileukemia agent, occurs in a wide variety of bacteria. A survey revealed that *Proteus vulgaris* NRRL-B123 was one of the best producers of this enzyme, yielding approximately 0.1 IU

(international unit) per ml of culture or 0.07 IU per mg dry weight. When the medium was changed to 3% yeast extract, 0.5% glucose, and 0.1% K_2HPO_4 , yield increased in a 16 hour fermentation at 28° C. to 2.6 IU/ml or 0.7 IU/mg dry weight. Out of a wide variety of nitrogen sources tested, none equaled yeast extract in stimulating enzyme yield; tryptone and prime meat peptone were about 60% as effective; corn steep liquor was about 50%. No carbohydrate tested excelled glucose for inducing enzyme formation. Titer of enzyme reached a peak or plateau at between 12 and 16 hours and declined thereafter.

- 3896 • Steam Jet Cooking of Unmodified and Modified Cereal Flours. Evaluation of Paste Properties, Papermaking Uses and Flocculation Activity
J. C. Rankin, B. S. Phillips, W. M. Doane, and C. R. Russell
Staerke 28(5): 174-179, May 1976

Steam jet cooking of unmodified and modified cereal flours increased paste dispersibility and decreased paste viscosity and paste setback to greater extents than did water bath or amylograph cooking. For modified flours prepared by dry-state procedures, jet cooking increased paste dispersibility and decreased paste and intrinsic viscosities considerably more for cationic flours than for an acid-modified flour. Improvements in dispersibility and viscosity properties of modified flours by jet cooking make them more effective in paper and flocculating applications.

- 3897 • Amylose-Iodine Complex. I. Sedimentation Behavior
F. R. Dintzis, A. C. Beckwith, G. E. Babcock, and R. Tobin
Macromolecules 9(3): 471-478. May-June 1976

Sedimentation measurements are reported on solutions of blue amylose-iodine complexes in the range of 0.001% to 0.007% amylose. Amylose fractions B and F₂, of weight average molecular weights 4.0×10^5 and 3.4×10^4 , respectively, were used. Iodine complexes of these fractions formed polydisperse solutions of limited solubility and stability. Sedimentation coefficients increased as a function of potassium iodide concentration: Values for fraction B complexes varied from $(16.3 \pm 1.0) \times 10^{-13}$ at $1.2 \times 10^{-3} M$ KI to $(57.2 \pm 7.5) \times 10^{-13}$ at $8.3 \times 10^{-3} M$ KI; values for fraction F₂ complexes varied from $(10.0 \pm 1.2) \times 10^{-13}$ at $1.2 \times 10^{-3} M$ KI to $(24.8 \pm 3.9) \times 10^{-13}$ at $9.5 \times 10^{-3} M$ KI. At constant potassium iodide concentration, sedimentation coefficients, within our experimental error of 10% to 15% standard deviation, are independent of amylose concentration. Time dependence of sedimentation coefficient values was observed for solutions either saturated or unsaturated with respect to the iodine-binding capacity of amylose. For iodine-saturated complex solutions, sedimentation coefficients extrapolated to zero potassium iodide concentration were two to three times greater than for the parent amylose. Measurements are evaluated in terms of possible polyelectrolytic

charge effects and aggregation. Under conditions used in our experiments, aggregation of amylose-iodide complexes appears to be the mechanism responsible for the large increase in sedimentation coefficients.

- 3898 • Amylose-Iodine Complex. II. Molecular Weight Estimates
F. R. Dintzis, R. Tobin, and A. C. Beckwith
Macromolecules 9(3): 478-482. May-June 1976

Ultracentrifugation measurements made by the Archibald method on solutions of amylose-iodine-iodide (AI) complexes, containing 0.003% amylose of weight average molecular weight 4.0×10^5 at $3.6 \times 10^{-3} M$ KI, yield an apparent molecular weight at the meniscus of 8×10^5 when measurements are extrapolated to 1200 rpm. Sedimentation equilibrium measurements at 1200 rpm yield apparent molecular weight at the meniscus of 6×10^5 and at the cell bottom of 2.4×10^6 . Heterogeneity and aggregation are major features of AI complex solution behavior. Apparent molecular weights increase as a function of increasing potassium iodide concentration and with time. This behavior directly correlates with AI complex sedimentation coefficient behavior previously reported. Molecular weight estimates are of the same order for AI complex solutions saturated and 65-70% saturated with respect to the iodine binding capacity of amylose. Estimates of net macroion charge effects upon apparent molecular weights are qualitative.

- 3899 • Starch-Encapsulated Pesticides for Slow Release
B. S. Shasha, W. M. Doane, and C. R. Russell
J. Polym. Sci., Polym. Lett. Ed. 14(7): 417-420. July 1976

Oxidatively coupled starch xanthate was used to encapsulate herbicides, insecticides, and male lures. Volatility and rate of release of these compounds were reduced significantly by this process.

- 3900 • Colonial Variation in *Xanthomonas campestris* NRRL B-1459 and Characterization of the Polysaccharide from a Variant Strain
M. C. Cadmus, S. P. Rogovin, K. A. Burton, J. E. Pittsley, C. A. Knutson, and Allene Jeanes
Can. J. Microbiol. 22(7): 942-948. July 1976

Stock cultures of *Xanthomonas campestris* NRRL B-1459 require special attention to maintenance and propagation to assure consistent production in good yields of the extracellular polysaccharide xanthan. Under customary conditions of propagative maintenance on agar slants, variant colony types develop that are smaller in size than the normal type. The rate of regression of the normal to the variant forms was diminished when the D-glucose content of the

stock medium was sufficient to avoid depletion during storage and when transfer to fresh medium was reduced to 14-day intervals. Under conditions for polysaccharide production, the normal large-colony type gives crude culture liquors after 48 hours of 7000 centipoise (cP) viscosity; the predominant variant form gives only 4000 cP. On the basis of 2.1% initial D-glucose, biopolymer yields for the normal and variant strains were 62 and 43%, respectively. Polysaccharide produced by the variant (small-colony type) differs adversely in solution properties from that of the parent strain (large-colony type); it differs also in its lower content of pyruvic acid and O-acetyl substituents. The molar ratios of constituent sugars (D-glucose, D-mannose, and D-glucuronic acid), however, were identical in polysaccharides with the normal and variant strains. Exclusion of colonial variants from fermentations is prerequisite to production of xanthan optimum in properties and yield.

3901* • Large Scale Production, Purification and a Study of Some Spectral Properties of Penitrem A

M. Malaiyandi,¹ R. F. Vesonder, and A. Ciegler
(¹Agriculture Canada, Ottawa, Ontario)

J. Environ. Sci. Health Part B 11(2): 139-164. 1976

A large scale production of the toxin, Penitrem A, from the cultures of *Penicillium* (*P.*) *palitans* and *P. crustosum* for studying its spectral characteristics is attained. From several fermentation runs, it would appear that *P. crustosum* produced nearly 80% more toxic metabolite than *P. palitans*. A single-step isolation of the tremorgen from the crude extract of the mycelial mats using silica-gel column is described. Some spectral properties of Penitrem A are discussed.

3902 • Morphine and Codeine in Poppy Seed

M. D. Grove, G. F. Spencer, M. V. Wakeman, and H. L. Tookey
J. Agric. Food Chem. 24(4): 896-897. July-August 1976

Poppy seed (*Papaver somniferum* L.) was analyzed for free and bound morphine and codeine by gas chromatography. A commercial sample of blue seed contained 0.5 to 1.7 p.p.m. of free morphine and 0.1 to 0.5 p.p.m. of free codeine. Bound alkaloids liberated by acid hydrolysis from two sources of blue and one source of white seed ranged from 0.6 to 4.2 p.p.m. of morphine and from 0.5 to 1.5 p.p.m. of codeine. The identity of the alkaloids was confirmed by gas chromatography-mass spectrometry of their trimethylsilyl ether derivatives.

- 3903 • Ultrastructure of Ascospores from *Debaryomyces melissophilus*,
A New Taxonomic Combination
C. P. Kurtzman and N. J. W. Kreger-van Rij¹
(¹State University, Groningen, The Netherlands)
Mycologia 68(2): 422-425. March-April 1976

Scanning electron microscopy showed the ascospores of *Pichia melissophila* to be covered with wartlike protrusions, whereas transmission electron microscopy showed the ascospore wall to consist of a thin outer layer and a thick inner layer that formed these protrusions. Since the ascospore ultrastructure, as well as general cell morphology, was typical of *Debaryomyces*, this species was assigned to that genus as *D. melissophilus*.

- 3904* • Homogeneous Catalytic Hydrogenation of Unsaturated Fats
E. N. Frankel
J. Oil Technol. Assoc. India 7(1): 3-16. January-March 1975

A catalyst has long been sought for selective hydrogenation of linolenate constituents contributing to flavor instability of soybean oil. A new approach to selective hydrogenation was the use of soluble organometallic compounds as hydrogenation catalysts. One objective was to determine whether greater selectivity is possible with soluble organometallic catalysts than with the conventional heterogeneous metal catalysts. Another objective was to gain a better understanding of the catalytic mechanism of fat hydrogenation. Effective homogeneous catalysts studied for the hydrogenation of unsaturated fats include: pentacyanocobaltate(II), metal carbonyls, metal acetylacetonates, and triphenylphosphine complexes of platinum, palladium, and nickel. Characteristics of iron and chromium carbonyl complex catalysts are important because of their theoretical and practical potential. The chromium carbonyl complex catalysts are of particular interest because they are stereoselective for the hydrogenation of polyunsaturated fats and yield predominantly *cis* unsaturated products without formation of saturates.

- 3905 • Aflatoxin Problem in Corn and Possible Solutions
E. B. Lillehoj and M. S. Zuber¹
(¹ARS, USDA, University of Missouri, Columbia)
Proc. 30th Annu. Corn and Sorghum Research Conf. (sponsored
by American Seed Trade Assoc.) at Chicago, Ill., December 9-11,
1975, pp. 230-250. 1976

This review contains a brief historical analysis of *Aspergillus flavus* infection of agricultural commodities and the elaboration of aflatoxin. The implications of a naturally occurring carcinogen in foods and feeds are

considered. All the information available on aflatoxin contamination of corn is summarized with details of production of toxin in the crop before harvest. Evidence for regional variation in aflatoxin development and variation in susceptibility of corn hybrids to *A. flavus* infection are identified. The effect of insects in the initial *A. flavus* infection in developing corn ears is considered. Finally an overview is made of the problem in terms of prevention of aflatoxin formation and managing aflatoxin-contaminated commodities.

- 3906 • High-Amylose Starch Xanthides in Rubber. The Effect of Coupling Agent and Filler on Properties of Starch Reinforced Styrene-Butadiene Rubbers
H. C. Katz, W. F. Kwolek,¹ R. A. Buchanan, W. M. Doane, and C. R. Russell
(¹Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)
Staerke 28(6): 211-215. June 1976

High-amylose starch xanthide-SBR vulcanizates resist absorption of water better than do vulcanizates containing low-amylose xanthide. The consistently higher dry tensile properties found in vulcanizates prepared with waxy maize and corn starch xanthide suggest that such xanthides are present as smaller and more uniformly distributed particles. Xanthates of the high-amylose starches were turbid, probably due to the presence of retrograded starch. Xanthides formed from such material may not reduce to particles small enough to provide the reinforcement obtained with low-amylose xanthates.

- 3907 • Methylation and Acetolysis of Extracellular D-Mannans from Yeast
F. R. Seymour, M. E. Slodki, R. D. Plattner, and R. M. Stodola
Carbohydr. Res. 48(2): 225-237. June 1976

Methylation-fragmentation analyses were conducted on a series of extracellular, yeast α -D-linked mannans representing six different structural types. D-Mannans of low degree of branching were produced by *Hansenula capsulata* strains and by species related to *H. holstii*. The former consisted primarily of (1 \rightarrow 2)- and (1 \rightarrow 6)-linked D-mannosyl residues; the latter, of (1 \rightarrow 2)- and (1 \rightarrow 3)-linked D-mannosyl residues. Although the remaining structural types were highly branched, each gave distinct methylation-patterns indicative of (1 \rightarrow 6)-linked backbones to which are appended non-(1 \rightarrow 6)-linked side-chains. Acetolysis studies were correlated with the methylation analyses, and the correlation demonstrated that each branched polymer possesses side chains of heterogeneous length.

- 3908 • Exoenzymic Activity by α -Amylase Immobilized on a Phenol-Formaldehyde Resin
J. A. Boundy, K. L. Smiley, C. L. Swanson, and B. T. Hofreiter
Carbohydr. Res. 48(2): 239-244. June 1976

Amylose and amylopectin from two starch sources were partially degraded by α -amylase immobilized on a phenol-formaldehyde resin. The degradation products were fractionated by gel-permeation chromatography and high-pressure, liquid chromatography. Two distinct fractions were obtained from tapioca amylose. One is a fragment having a molecular weight exceeding 200,000, and the other consists of oligosaccharides of low molecular weight with a degree of polymerization of 1-8. In contrast, treatment of tapioca amylose with soluble α -amylase produces a single fraction, nearly all of which has a molecular weight of <35,000, with only traces of small oligosaccharides detectable by high-pressure, liquid chromatography. Even wider differences were observed in degradation products from tapioca amylopectin. Similar activity patterns were obtained with immobilized and soluble enzymes, using corn amylose and corn amylopectin as substrates. Immobilization of α -amylase on the resin apparently restricts the activity of the enzyme to the ends of the starch molecules, making it appear to be limited to exoenzymic activity.

- 3909 • *Aspergillus flavus* and Aflatoxin in Iowa Corn Before Harvest
E. B. Lillehoj, D. I. Fennell, and W. F. Kwolek¹
(¹Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)
Science 193(4252): 495-496. August 1976

Aspergillus flavus and aflatoxin were detected in ears of Iowa corn on plants before harvest in 1975. Presence of the fungus was associated with kernel injury caused by the second generation European corn borer. Amounts of aflatoxin B₁ in corn from a limited number of selected ears ranged from 1 p.p.b. to 1,560 p.p.b. with a mean of 430 p.p.b.

- 3910 • Starch Xanthide in Pilot Paper Machine Trials
G. E. Hamerstrand, M. E. Carr, B. T. Hofreiter, and C. R. Russell
Staerke 28(7): 240-243. July 1976

Starch xanthate, an inexpensive water-soluble derivative of starch, was oxidatively converted in the insoluble xanthide and evaluated on a pilot paper machine as a wet- and dry-strength additive for unbleached kraft paper. Pilot data are compared with data reported previously that were obtained in laboratory evaluations. Differences observed in xanthide effectiveness on scale-up from laboratory to pilot evaluations are described, and the variables responsible identified.

3911 • Sperm Oil Replacements from Selectively Hydrogenated Soybean and Linseed Esters: Special Lubricants

E. W. Bell, J. C. Cowan, L. E. Gast, and R. E. Koos¹

(¹Eastern Regional Research Center, ARS, USDA, Philadelphia, Pa.)
J. Am. Oil Chem. Soc. 53(7): 511-517, July 1976

Soybean and linseed oils were selectively hydrogenated with copper-on-silica gel catalyst. The linolenate content of the oils was reduced to diene and monoene with no appreciable increase in saturates. Hydrogenated soybean oils contained 68 to 76% monoene, 11 to 18% diene, 0% conjugated diene and triene, 1 to 6% conjugatable diene, 0 to 0.3% conjugatable triene, and 23 to 40% isolated *trans* double bonds. Hydrogenated linseed oils contained 44 to 54% monoene, 35 to 45% diene, 0% conjugated diene and triene, 0 to 7% conjugatable diene, 0 to 0.2% conjugatable triene, and 44 to 59% isolated *trans* double bonds. Esters of fatty acids, derived from these selectively hydrogenated oils, were prepared with trimethylolethane, trimethylolpropane, trimethylolbutane, pentaerythritol, ethylene glycol, C₁₈ saturated cyclic alcohols, primary C₁₂-C₁₈ saturated (nC₁₂, nC₁₄, nC₁₆, nC₁₈) alcohol, and primary C₁₆-C₁₈ saturated (nC₁₆, nC₁₈) alcohol blends. Measurements of viscosities and of smoke, flash, and fire points indicate that these esters are possible replacements for sperm oil. Certain of them, after sulfurization, also have potential as extreme pressure lubricant additives.

3912 • Vegetable Oils and Animal Fats as Renewable Resources for Plastics and Coatings Applications

E. H. Pryde, L. E. Gast, E. N. Frankel, and K. D. Carlson
Polym. Plast. Technol. Eng. 7(1): 1-26. 1976

About 35% of the total output from the fats and oils industries goes into non-food applications, including products useful to the plastics and coating industries. In order of decreasing importance to non-food uses are tallow and grease, tall oil, coconut oil, linseed oil, and soybean oil. Despite inroads of petroleum-derived chemicals, drying oils are still important to the coatings industry and amounted to 673 million pounds in 1973. Probably the next most important outlet in plastics is for plasticizers, which amounted to 258 million pounds in 1972, or 15% of the total plasticizer market. Other important uses include lubricant additives for plastics and such dicarboxylic acid intermediates as azelaic, sebacic, and dimer acids. Although the fats and oils industry is not large enough to serve as the main base of supply for all plastics and coatings, its importance to these products can be expected to grow as petrochemical shortages and prices encourage the use of other source materials. Some new fatty acid-based products that have potential value to U.S. economy include polyesteramide alkyds, ester-acetal plasticizers, nylon 9 and nylon 13/13 engineering thermoplastics, and carboxystearic acids. New oilseed crops of potential value include crambe as a source for C₂₂ fatty acids, and *Lesquerella* and jojoba oils as respective replacements for castor and sperm oils.

- 3913 • Engineered Foods of the Future--Baked Foods Fortified with Vegetable Protein
D. D. Christianson
Bakers Dig. 50(3): 34-36. June 1976

New baked products can be prepared from wheat, potato or corn starch and xanthan gum. These baked products resemble bread in texture and crust. The xanthan gum-starch film matrix has better elastic properties than other starch-gum systems. Products can be fortified with soy protein to levels as high as 22% which is equivalent to protein content of most luncheon meats. This polysaccolloid can provide the visco-elastic properties of gluten in the development of yeast-leavened, gluten-free, products such as rolls, buns, and yeast-raised doughnuts. The simple method of preparation expands the potential for the use of starches and low protein flours in engineered baked goods systems with the added prospect of vegetable protein fortification.

- 3914 • Antitumor Activity of *Sesbania vesicaria*, *S. punicea*, and *S. drummondii* Seed Extracts
R. G. Powell, C. R. Smith, Jr., and R. V. Madrigal
Planta Med. 30(1): 1-8. August 1976

Screening ethanolic seed extracts for antitumor activity revealed that *Sesbania vesicaria*, *S. punicea*, and *S. drummondii* are significantly active against lymphocytic leukemia P-388 (PS) *in vivo*. Approximately, a 100-fold enrichment has been achieved of the active principle(s) of *S. vesicaria*. The ethanolic extract contains sucrose, raffinose, stachyose, several triterpene saponins, sterol glycosides, and substantial amounts of phospholipids. Acid hydrolysis of a saponin concentrate revealed oleanolic acid and an unidentified isomer of hederagenin, possibly queretaroic acid. The major sterols are stigmasterol and β -sitosterol. Antitumor activity of *S. vesicaria* is associated with a minor, as yet unidentified, constituent. The isolated saponins are relatively non-toxic and inactive,

- 3915 • Halogenated Polyallyl Ethers in Flame-Retardant Urethane Foams
F. H. Otey, C. A. Wilham, A. M. Mark, and C. R. Russell
Ind. Eng. Chem. Prod. Res. Dev. 15(3): 183-186. September 1976

Polyallyl ethers of glycol glycosides and sorbitol were prepared and then halogenated by addition of Br₂, Cl₂, CCl₄, and HOCl. Since these products have at least one free hydroxyl per molecule and from 20 to 64% halogen, they were evaluated as reactive flame-retardant additives for polyurethane foams. Although the halogenated products have high viscosities, they dissolve in blowing agents and polyethers to yield formulations with acceptable viscosities for producing low density foams suitable for insulation. The HOCl adducts have acceptable hydroxyl numbers for producing foams without any added polyol, whereas the other adducts, having low hydroxyl numbers,

require blending with conventional polyethers to be suitable. At low levels of halogen, both CCl_4 and HOCl adducts are significantly more effective as flame retardants in foams than those made by direct addition of free halogen.

- 3916 • Aflatoxin Contamination, Fluorescence, and Insect Damage in Corn Infected with *Aspergillus flavus* Before Harvest
E. B. Lillehoj, W. F. Kwolek,¹ R. E. Peterson, O. L. Shotwell, and C. W. Hesseltine
(¹Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)
Cereal Chem. 53(4): 505-512, July-August 1976

Aspergillus flavus was observed on corn ears in South Carolina fields before harvest generally in association with insect activity. *A. flavus*-infected seed and characteristic kernel fluorescence were related to the presence of aflatoxin in corn samples. Fungal-contaminated kernels routinely exhibited two types of fluorescence: either bright greenish-yellow in the germ margin or intense yellow throughout the endosperm.

- 3917 • Cuticular Hydrocarbons of Healthy and Diseased Japanese Beetle Larvae
G. A. Bennett and O. L. Shotwell
Insect Biochem. 6(4): 345-346. 1976

Hydrocarbons were extracted from cuticle of healthy Japanese beetle larvae infected with the milky disease organism, *Bacillus popilliae*. The extractable hydrocarbons were separated from other lipids by silicic acid column chromatography and analyzed by gas-liquid chromatography. The major cuticular hydrocarbons are *n*-tricosane, 11-methyltricosane, and 9,13-dimethyltricosane. Only minor quantitative differences were observed in the major hydrocarbons from cuticle of healthy and diseased larvae.

- 3918 • Sporulation in *Pichia spartinae*
C. P. Kurtzman and D. G. Ahearn¹
(¹Georgia State University, Atlanta)
Mycologia 68(3): 682-685. May-June 1976

The yeast *Pichia spartinae* was originally described as being homothallic and forming round ascospores, but this description could not be verified because the original cultures no longer sporulated. Freshly isolated cultures of *P. spartinae* formed hat-shaped ascospores and were heterothallic. Mating and sporulation occurred between appropriate single ascospore isolates from the newly isolated strains and the type cultures of *P. spartinae*. Because mating did not occur between *P. spartinae* and similar heterothallic species of *Pichia*, they must be distinct species.

- 3919 • Identification of Polysaccharide-Producing Black Yeasts
K. A. Burton, L. K. Nakamura, and M. C. Cadmus
Mycologia 68(3): 685-688. May-June 1976

Two black yeastlike fungi, NRRL Y-6272 and NRRL YB-4163, which produce extracellular polysaccharide composed of either *N*-acetyl glucosamine or *N*-acetyl glucosaminuronic acid residues, or both, have now been classified as *Rhinoctadiella mansonii* and *Rhinoctadiella elatior*, respectively. Injections of these fungi into mice and guinea pigs indicate that these organisms are not pathogenic.

- 3920 • Yellowing and Other Film Properties of Linseed-Derived Paints Influenced by Linolenate Content
H. Rakoff, F. L. Thomas, and L. E. Gast
J. Coat. Technol. 48(619): 55-57. August 1976

Extent of yellowing on storage in the dark (measured spectrophotometrically), drying time, and hardness were determined on four experimental paints prepared with one of the following as the vehicle: an alkali-refined linseed oil (ARLSO), a decolorized linseed oil (DLSO), pure trilinolenin (Ln_3), or a bleached hydrogenated linseed oil (BHLSO). These oils ranged in linolenate content from 0 to 100%. The Ln_3 paint dried the fastest and yellowed the most. ARLSO paint yellowed just a little more than did the DLSO paint. The BHLSO paint dried slowly, did not yellow perceptibly, and reached about one-half the Sward Rocker Hardness of the other three paints.

- 3921 • Analytical Variation When Proportions of Sampled Units Contain the Active Agent
W. F. Kwolek¹ and E. B. Lillehoj
(¹Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)
J. Assoc. Off. Anal. Chem. 59(4): 787-794. July 1976

When a product consisting of discrete units is sampled, the number of units to be selected depends on p , the proportion of units containing an active agent. If the sample is ground, the problem of subsample size is complicated when only a proportion, g , of the subparticles generated from each unit containing the active agent is active. Procedures have been devised for determining sample size, subsample size, and fineness of grind for wide ranges of p and g . The expected precision of the analytical results is influenced by both sampling variation and analytical variation.

3922 • Mycotoxins Other Than Aflatoxins

C. W. Hesseltine

Proc. 3d Int. Biodegradation Symp., Kingston, R.I., August 17-23, 1975, eds. J. Miles Sharpley and Arthur M. Kaplan, Sect. XIV, pp. 607-623. London, England. 1976

Some fungi growing on food and feed produce toxic products both in the field and after harvest, besides the *Aspergillus flavus* group that form aflatoxins. Effects of these other toxins on animals are varied and include some carcinogenic and estrogenic symptoms, loss of weight, liver damage, hemorrhage, and rejection of feed. In some instances, toxins are produced by the host plant in response to the fungus infection or physical injury rather than being produced directly by the fungus. Some of the most important mycotoxins, besides the aflatoxins, will be described in respect to causal agent, chemistry, natural occurrence, and acute and chronic toxicity. Generally, the toxins are produced by members of the genera *Aspergillus*, *Penicillium*, *Fusarium*, *Alternaria*, and the class Fungi Imperfecti. These compounds are ochratoxin, T-2, zearalenone, penicillic acid, citrinin, patulin, corn rejection factor in swine, alternariol and related compounds, and sterigmatocystin.

3923 • Paper Mill Effluent Clarified with Immobilized Alpha-Amylase

K. L. Smiley, B. T. Hofreiter, J. A. Boundy, and S. P. Rogovin

Proc. 3d Int. Biodegradation Symp., Kingston, R.I., August 17-23, 1975, eds. J. Miles Sharpley and Arthur M. Kaplan, Sect. XV, pp. 1001-1011. London, England. 1976

The clarification of paper mill wastewaters before return to natural streams is ecologically necessary and economically advantageous. Some mill wastewaters that contain starch are colloidal dispersions of pigments and fiber fines highly resistant to conventional clarification methods. Degradation of the starch in such waste by soluble α -amylase significantly aids alum flocculation of suspended solids. Earlier, we substituted immobilized α -amylase for soluble α -amylase in this application. Now we report the successful use of an α -amylase-phenol-formaldehyde resin complex in a continuously stirred tank reactor to degrade oxidized starch in simulated "white water." The relationships of clarification rates to holding time of white water in the enzyme reactor and the level of alum were determined. Significant reductions of the amounts of alum required to provide an acceptable degree of primary clarification and the apparent stability of the enzyme complex suggest commercial feasibility.

3924* • Scanning Electron Microscopy in Coatings Research

L. H. Princen

In "Treatise on Coatings," eds. R. R. Myers and J. S. Long, vol. 2, pt. 2, chap. 7, pp. 377-411. New York. 1976

The scanning electron microscope is described and explained, and detailed information is given about the main instrument controls, such as those for the electron gun, lenses, scan generator, and stigmator, as well as contrast and intensity regulation. Sample preparation for viewing in the scanning electron microscope and the possibility of introducing artifacts during application of a thin metal coating are described. Examples of the use of the instrument in coatings research are given with particular emphasis on the study of pigments, binders, binder-pigment, and binder-substrate interactions. Also, relevant published research is reviewed.

- 3925 • Viscous Product from Activated Sludge by Methanol Fermentation
E. N. Davis and L. L. Wallen
Appl. Environ. Microbiol. 32(2): 303-305. August 1976

Aeration of activated sludge with 3 to 4% added methanol for 5 to 7 days yields an odorless, highly viscous (5,000 to 10,000 cP) black pudding-like product containing glycan(s) linked other than α -1-4 or β -1-3. Backseeding gives maximum thickening in 3 to 4 days. Acid hydrolysis of the black product gives a 0.27% solution of reducing sugars (75% glucose) which is an 11.4% yield from the added methanol. Backseeding either into centrifuge supernatant or into 0.1% yeast extract in tap water gives a light-colored polymer. Viscosity decreases during extended sterile cold storage. A 5% salt addition lowers viscosity one half. From 6 to 12 colony types appear on plating backseeded media but none of these isolates are reliable polymer formers.

- 3926* • Synthesis of 1-Deuterioaldehydes
H. Rakoff
J. Labelled Compd. Radiopharm. 12(3): 473-475. July-Sept. 1976

Nonanal-1-*d* was prepared by reducing nonanoyl chloride with lithium tri-*t*-butoxyaluminodeuteride. Infrared, nuclear magnetic resonance, and mass spectral evidence support the assigned structure.

- 3927 • Fate of Jimsonweed Seed Alkaloids in Soybean Processing
G. R. List and G. F. Spencer
J. Am. Oil Chem. Soc. 53(8): 535-536. August 1976

The fate of Jimsonweed seed alkaloids (atropine and scopolamine) during solvent extraction of contaminated soybeans and alkali refining of crude oil was investigated. Extraction of a 50:50 mixture of soybeans and Jimsonweed seeds with petroleum ether yielded meal and crude oil fractions, in which

chemical analyses showed that virtually all the atropine and scopolamine remained in the meal. Alkali refining effectively removed atropine added to crude soybean oil.

3928 • Syntheses of Tetra- and Hexadeuterated Octadecenoates

W. J. DeJarlais and E. A. Emken

Lipids 11(8): 594-598. August 1976

A study of the metabolism in man of *cis* and *trans* monoenoic acids required the synthesis of tetra- and hexadeutero-9-octadecenoates. Preparation of methyl 9-octadecenoate-8,8,11,11- d_4 (90 mole % deuterium) by the Wittig reaction was accompanied by deuterium scattering with sodium methoxide as the base but not with alkyllithium. Scattering occurred in both the aldehyde and phosphorane moieties only when the aldehyde contained deuterium on the alpha carbon. Methyl 9-octadecenoate-8,8,13,13,14,14- d_6 (98 mole % deuterium) was also prepared by the Wittig reaction. The deuterated octadecenoates were formed principally as *cis* isomers. The *trans* isomers were produced by nitrogen oxide isomerization and separation on a silver ion column.

3929 • Mass Spectra of Acetylenic Fatty Acid Methyl Esters and Derivatives

R. Kleiman, M. B. Bohannon, F. D. Gunstone,¹ and J. A. Barve¹
(¹St. Salvators College, University of St. Andrews, St. Andrews, Scotland)

Lipids 11(8): 599-603. August 1976

A series of isomeric methyl octadecynoates was analyzed by mass spectrometry; each isomer gave a unique spectrum. The characteristic ions were those resulting from a McLafferty rearrangement of the allenic sites or of the already-rearranged allenic sites. The acetylenic esters were also subjected to oxymercuration when a carbonyl group was formed at either of the original acetylenic carbon atoms providing two oxostearates. Further reaction with NaBH_4 formed hydroxy esters which, after silylation, gave diagnostic mass spectra indicative of the triple bond location. Applied to esters with both double and triple bonds, this procedure permitted differentiation between the two types of unsaturation. Methoxyl groups marked the original double bond locations and hydroxyls did so for triple bonds.

3930* • Composition and Functional Properties of Milled Fractions of Triticale

R. A. Anderson, A. C. Stringfellow, and J. S. Wall

Proc. Int. Triticale Symp., Lubbock, Texas, Sept. 18-19, 1973, pp. 83-94. 1976

Triticale grain can be dry milled to provide flour and flour fractions. Starch and gluten can be recovered from triticale grain or flour by conventional wet processing. Triticale is a good potential source of protein-rich supplements for food products, as well as a source of flour and starch fractions for food, feed, and industrial applications.

3931* • Further Investigation and Identification of Growth Promoting Effects of Fungus-Fermented Soybeans for Broilers

C. C. Chah,¹ C. W. Carlson,¹ G. Semeniuk,¹ I. S. Palmer,¹
and C. W. Hesseltine

(¹South Dakota State University, Brookings)

Poult. Sci. 55(3): 911-917. May 1976

Five factorially designed studies were conducted to test the growth-promoting activities of fungus-fermented soybeans for broilers and to ascertain further what factor(s) is responsible for the positive growth response obtained from feeding fermented soybean diets. Data from the first three studies (4 types of soybeans x 3 levels of protein) have demonstrated that feeding soybeans fermented with 6 of the 11 species of Aspergilli gave significantly ($P < 0.01$ or $P < 0.05$) improved weight gain and feed efficiency. The responses were greatest on the lowest protein diets, confirming our previous reports. In the last two studies (5 types of soybeans x 3 levels of protein) control diets supplemented with essential amino acids to simulate the amino acid composition of the fermented soybeans produced similar positive growth effects and improved feed utilization.

3932* • Fungus-Fermented Soybeans Benefit the Life Cycle of Japanese Quail (*Coturnix coturnix japonica*)

C. C. Chah,¹ R. A. Nelson,¹ C. W. Carlson,¹ G. Semeniuk,¹
I. S. Palmer,¹ and C. W. Hesseltine

(¹South Dakota State University, Brookings)

Poult. Sci. 55(3): 975-981. May 1976

Feeding quail chicks diets containing soybeans fermented with two cultures of Aspergilli (*A.oryzae* NRRL 451 and *A. oryzae* NRRL 506) resulted in significantly superior weight gains ($P < 0.05$) through a 4-week growth period and confirmed previous observations made with identical cultures in broiler studies. Subsequent hen-day egg production and egg size were changed little by diets containing fermented soybeans. The numerical increases in fertility and hatchability were not significant. Progeny also responded to the fermented soybean diets, some carry-over effects were evident.

3933* • Polymer Solutions

E. B. Bagley and J. M. Scigliano¹

(Monsanto Company, St. Louis, Mo.)

In "Solutions and Solubilities," ed. Michael R. J. Dack, vol. 8, pt. 2, chap. 16, pp. 437-485. New York. 1976

In recent years environmental regulations, for example the Los Angeles County Air Pollution Control District Rule 66, have forced the reformulation of many long-accepted polymer/solvent systems. The practical success of these reformulations has provided a valuable insight into the behavior of liquids and solutions. This review compares recent theoretical developments with industrial experience and explains why the solubility parameter concept can be so effectively extended to polymer/solvent systems even when strong polar effects and specific chemical interactions occur. Empirical developments, usually at best semi-quantitative, can be made completely quantitative when volume changes on mixing are considered and when interaction energies of the pure components are correctly described. Experimental methods of determining polymer/solvent interactions are summarized briefly. These methods are valuable when the more fundamental data needed for quantitative calculations are not accessible.

3934 • Double Bond Position Affects Metabolism of *cis*-Octadecenoates

T. L. Mounts

Lipids 11(9): 676-679. September 1976

The metabolic fate of *cis*-positional isomers of octadecenoates has been compared to that of naturally occurring oleic acid (*cis*- $\Delta 9$). Radioactive mixtures of tritium-labeled positional octadecenoate isomer and oleic acid-10-¹⁴C were administered to laying hens, and their eggs were analyzed for the isotopic ratios (³H/¹⁴C) incorporated into total egg lipid, triglycerides, and phospholipids. Variations in the isotopic ratios indicated the comparative metabolic utilization of *cis*-positional isomers $\Delta 8$ through $\Delta 12$. Incorporation into egg lipid fractions is as follows: triglycerides: $\Delta 9 > \Delta 8$, $\Delta 9 > \Delta 10$, $\Delta 9 > \Delta 11$, $\Delta 9 > \Delta 12$; phospholipid: $\Delta 9 > \Delta 8$, $\Delta 9 > \Delta 10$, $\Delta 9 > \Delta 11$, $\Delta 9 > \Delta 12$.

3935* • Time-Dependent Disappearance of Ochratoxin A Residues in Tissues of Bacon Pigs

P. Krogh,¹ F. Elling,² Benedicte Hald,² A. E. Larsen,³E. B. Lillehoj, A. Madsen,³ and H. P. Mortensen³(National Food Institute, Soborg, Copenhagen, Denmark; ²Royal Veterinary and Agricultural University, Copenhagen, Denmark;³National Institute of Animal Science, Copenhagen, Denmark)

Toxicology 6: 235-242. 1976

Crystalline ochratoxin A was administered to bacon pigs for 1 month. After termination of toxin exposure the pigs were slaughtered at different intervals and analyses for ochratoxin A residues in four tissues were conducted. Kidneys contained the highest concentrations, and fat the lowest, at each interval. Ochratoxin A disappeared from muscle and fat after 2 weeks, from liver after 3 weeks, and from the kidneys after 4 weeks. The toxin disappeared from tissues exponentially. All the pigs would have passed the meat inspection because no pathologic lesions were developed although tissues contained mycotoxin residues. The results of this study indicate that contamination of meat by ochratoxin A may be avoided by feeding pigs ochratoxin-free feed during the last 4 weeks before slaughter.

3936 • Mycotoxin Research in India

C. W. Hesseltine

Mycopathologia 58(3): 157-163. 1976

Judging from personal contacts and from a literature survey, the major centers in India working on mycotoxins are located at the Central Food Technological Research Institute, Mysore; the Department of Biochemistry, Vallabhbhai Patel Chest Institute, University of Delhi; Nutrition Research Laboratories, Hyderabad; and Department of Botany and Microbiology, S. V. University, Tirupati. Practically all work is devoted to various aspects of the aflatoxin problem. Although the Department of Plant Pathology and Botany at the University of Allahabad, Allahabad, has conducted related studies on the mold flora of various grains of India, it has never been directly involved in mycotoxins,

Each center has worked in a different area. Work at Mysore has been somewhat biochemical, although major efforts have been in surveying peanuts, peanut oil and meal and in developing analytical methods. The University of Delhi has concentrated primarily on the biochemistry of the aflatoxins. At Hyderabad, research is directed toward animal studies and resistance to aflatoxin formation in varieties of peanuts. At Tirupati, studies have been devoted more to mycology, in addition to investigating the aflatoxin problem in peanuts.

3937 • Kenaf for Hardboards

M. O. Bagby and T. F. Clark

Tappi CA Report No. 67, "Non-Wood Plant Fiber Pulping--Progress Report No. 7," pp. 9-13. Atlanta, Ga. September 1976

Frost-killed kenaf was evaluated as a hardboard raw material, and the results demonstrate its use to be technically feasible. Boards with densities of 0.78 to 1.15 g/cc had tensile strengths ranging from 2980 to 11,150 psi. The boards compare favorably with wood specimen with densities and tensile strengths of 1.02 g/cc and 5080 psi, respectively.

- 3938* • Corn Earworm Damage and Aflatoxin B₁ on Corn Ears Protected with Insecticide
 N. W. Widstrom,¹ E. B. Lillehoj, A. N. Sparks,¹ and W. F. Kwolek²)
 (¹Southern Grain Insects Research Laboratory, Tifton, Ga.;
²Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)
 J. Econ. Entomol. 69(5): 677-679. October 1976

Four dent corn hybrids (3 in 1974 and 1 in 1975) were tested in split-plot experiments that included artificial versus natural infestation of ears with *Heliothis zea* (Boddie), inoculation of ears with *Aspergillus flavus* Link ex Fries versus no inoculation, and ears sprayed with stirofos versus nonsprayed ears in 1974; included inoculation versus noninoculation and stirofos treated bags versus nontreated bags in 1975. Aflatoxin B₁ production and corn earworm injury were recorded. No evidence was found in either year for a significant relationship between corn earworm injury and the presence of aflatoxin B₁. The insecticide regimen which was designed to totally control insects in both years did not eliminate insect damage nor did it effectively preclude *A. flavus* infection of the ears and subsequent aflatoxin production.

- 3939 • Dialdehyde Starch Hydrazones: Preparation and Properties of Cationic Dispersions
 H. D. Heath, B. T. Hofreiter, P. J. Borchert,¹ M. I. Schulte, J. L. Neff,¹ and C. R. Russell
 (¹Sumner Division, Miles Laboratories, Inc., Elkhart, Ind.)
 Staerke 28(9): 303-308, September 1976

Cationic dialdehyde starch (DAS) dispersions have been prepared in water at 15% concentration by a new cooking procedure. A stable fluid form of cationic DAS, a wet- and dry-strength agent for paper, should facilitate commercial use. Cationic DAS dispersions of pH 3.0 stored in polyethylene containers at 25° C. or below were unchanged after 6 months; other storage conditions were also evaluated. An unexpected benefit of the new preparative conditions was a 40% reduction of cationizing agent, betaine hydrazide hydrochloride, without loss of effectiveness. Further savings may be possible by blending cationic DAS with unmodified starch; wet- and dry-strength improvements were maintained in paper with a blend containing 33% unmodified starch and 67% cationic DAS.

- 3940 • Treating Maize with Ammonia--A Controlled Storage Experiment
 E. B. Lancaster and R. J. Bothast
 J. Stored Prod. Res. 12(3): 171-175, September 1976

High-moisture corn was treated with ammonia and stored in two insulated 55-gal drums at 25° C. The corn was sampled periodically in one drum, and it became infected with *Scopulariopsis brevicaulis* mold. The fungus converted ammonia to high-lysine protein, removing ammonia from the headspace gas and copiously producing carbon dioxide. The other drum was not opened for 18 months, and symptoms of microbial activity were minimal. Both ammonia and storage affect sugars, proteins, and the form of nitrogen present.

- 3941 • Yoghurt Production by *Lactobacillus* Fermentation of Soybean Milk
H. Kanda, H. L. Wang, C. W. Hesseltine, and K. Warner
Process Biochem. 11(4): 23-26. May 1976

A simple and inexpensive method of treating soybean to improve the flavor of soybean milk is described. Fermentation of this milk by *L. acidophilus* strains and subsequent flavoring notably with lemon flavor have yielded an acceptable yoghurt. The yoghurt can be stored at 5° C. for up to 19 days without significant change.

- 3942 • Thin Layer Chromatographic Determination of Sterigmatocystin in Cereal Grains and Soybeans
G. M. Shannon and O. L. Shotwell
J. Assoc. Off. Anal. Chem. 59(5): 963-965. September 1976

A method has been developed to analyze sterigmatocystin, a carcinogen, in yellow and white corn, barley, oats, rye, sorghum, brown and wild rice, and soybeans. A partition column packed with activated magnesium silicate was used for cleanup. Average recoveries are 104% in white corn, 114% in rye, 100% in oats, 134% in brown rice, 96% in barley, 105% in sorghum and wild rice, and 92% in soybeans. The sensitivity limit is 50 µg/kg for any of these commodities.

- 3943 • Polysaccharide (Xanthan) of *Xanthomonas campestris* NRRL B-1459: Procedure for Culture Maintenance and Polysaccharide Production, Purification, and Analysis
Allene Jeanes, Peter Rogovin, M. C. Cadmus, R. W. Silman, and C. A. Knutson
Northern Regional Research Center, ARS, USDA, Peoria, Ill.,
ARS-NC-51, 14 pp. November 1976

Procedures developed and used at the Northern Regional Research Center are detailed for all aspects of producing and analyzing the extracellular anionic heteropolysaccharide of *Xanthomonas campestris* NRRL B-1459. Special precautions in use of the micro-organism, which is a plant pathogen, are indicated.

Compositions of media are given for culture maintenance, inoculum buildup, and production in batch cultures; and conditions are described for conducting these operations. Culture maintenance by nonpropagative or semi-propagative procedures is advised to insure consistent production of high quality xanthan in good yield.

Procedures and equipment are considered for three scales of operation--laboratory, semi-pilot plant, and pilot plant--for batch fermentation as well as for isolation and purification of xanthan. Methods are given for analyzing culture fluids, for evaluating quality of the xanthan product, and for determining constituent sugars and content of *O*-acetyl and pyruvate substituents. The basic principles and much of the specific detail stated for *Xanthomonas campestris* NRRL B-1459 apply also to the other microbial strains and their extracellular polysaccharides that have been discovered and developed at NRRC.

- 3944 • Celorbicol, Isocelorbicol, and Their Esters: New Sesquiterpenoids from *Celastrus orbiculatus*
C. R. Smith, Jr., R. W. Miller, David Weisleder, W. K. Rohwedder, Nancy Eickman,¹ and Jon Clardy¹
(¹Iowa State University, Ames)
J. Org. Chem. 41(20): 3264-3269. October 1976

Esters of two new sesquiterpenoid polyalcohols--celorbicol (1a) and isocelorbicol (2a)--have been isolated from *Celastrus orbiculatus*. Structures of the parent alcohols have been established by X-ray crystallography, and those of the derived esters have been assigned by NMR spectroscopy. These compounds are structurally related to other polyesters and ester alkaloids from the Celastraceae, all of which are based on the dihydroagarofuran ring system.

- 3945 • Kinetic Analysis of the Action of Soybean Lipxygenase on Linoleic Acid
J. W. Lagocki,¹ E. A. Emken, J. H. Law,¹ and F. J. Kezdy¹
(¹University of Chicago, Chicago, Ill.)
J. Biol. Chem. 251(19): 6001-6006. October 1976

The rate at which the enzyme lipxygenase catalyzes the oxygenation of the polyunsaturated fatty acid, linoleic acid, has been accurately measured. Analysis of the details of the rate linoleic acid is oxidized has permitted a scheme to be postulated which describes the exact sequence of conditions which must occur in order for lipxygenase to oxidize linoleic acid. Self destruction of the enzyme by its reaction products was not found contrary to previous reports.

3946 • Preferential Sulfonylation of Methyl 2,6-Di-*O*-mesyl- α -D-Glucopyranoside

H. B. Sinclair

Carbohydr. Res. 50(2): 247-256. September 1976

When equimolar ratios of mesyl chloride and methyl 2,6-di-*O*-mesyl- α -D-glucopyranoside were allowed to react in pyridine and the product resolved by preparative thin-layer chromatography, the 2,6-di-, 2,3,6-tri-, 2,4,6-tri-, and 2,3,4,6-tetra-mesyl esters were obtained in (0.5 to 0.6):1:(4 to 5):(1.2 to 1.4) molar ratio. Benzoylation of either the isolated 2,4,6-tri-*O*-mesyl ester or, more conveniently, the mixture from monomesylation gave the crystalline methyl 3-*O*-benzoyl-2,4,6-tri-*O*-mesyl- α -D-glucopyranoside. As both of these trimesyl esters are unreported, isolation of the benzoate established the 2,4,6-ester arrangement, and the 2,3,6-triester was prepared by standard methods. Treating methyl α -D-glucopyranoside with 3 molar equivalents of mesyl chloride and, subsequently, with 1 molar equivalent of benzoyl chloride, proved a convenient method for preparing the 3-*O*-benzoyl derivative in moderate yield. Monotosylation of methyl 2,6-di-*O*-mesyl- α -D-glucopyranoside was not so definitive as mesylation, but a molar ratio of 1:2.8 for the 3-*O*-tosyl:4-*O*-tosyl product was derived from NMR data. This work, when combined with literature reports, establishes that, in methyl α -D-glucopyranoside, the reactivity toward sulfonylation is 6-OH>2-OH>4-OH>3-OH.

3947* • Dimeric 6-Deoxy-1,2:3,4-di-*O*-isopropylidene- α -D-galactopyranos-6-yl

E. I. Stout, W. M. Doane, and V. C. Trinkus¹

(¹Bradley University, Peoria, Ill.)

Carbohydr. Res. 50(2): 282-286. September 1976

Magnesium reacts with 6-deoxy-6-iodo-1,2:3,4-di-*O*-isopropylidene- α -D-galactopyranose (I) to form a 12-carbon sugar. Facile methods are reported for the preparation of I and methyl 6-deoxy-6-iodo-2,3,4-tri-*O*-methyl- α -D-glucopyranoside.

3948 • Soy Beverages in World Feeding Programs

G. C. Mustakas

In "World Soybean Research," Proc. World Soybean Res. Conf.,

Urbana, Illinois, August 3-8, 1975, pp. 828-839. September 1976

Protein beverages based on soybeans have been tested and found acceptable in several countries. Two soy beverage processes have been developed at the Northern Regional Laboratory. Based on full-fat soy flours produced by an extrusion-cooking method, the first process yields a low-cost protein concentrate powder that can be reconstituted with water to a nutritious beverage.

This product has been promoted as part of the Mexican National Food Program to improve the protein quality of native foods in Mexico. A totally different process has now been developed that gives a second soy beverage with less carbohydrates and better suspension properties. This procedure promises to be useful for production of beverage bases that may be used as extenders, substitutes, or replacers for milk-based beverages.

3949 • The Genus *Cephalotaxus*: Source of Homoharringtonine and Related Anticancer Alkaloids

C. R. Smith, Jr., R. G. Powell, and K. L. Mikolajczak
Cancer Treat. Rep. 60(8): 1157-1170. August 1976

Various phases of research on *Cephalotaxus* alkaloids are summarized, including their discovery, nature of antitumor activity, isolation, structural characterization, synthesis, biogenesis, and mechanism of physiologic action.

3950 • Heterothallism in *Pichia kudriavzevii* and *Pichia terricola*

C. P. Kurtzman and M. J. Smiley
Antonie van Leeuwenhoek 42(3): 355-363. 1976

Pichia kudriavzevii and *P. terricola* were found to be heterothallic, but not interfertile with one another; nor did they mate with *P. membranaefaciens*, *P. scutulata*, *Candida lambica*, *C. diversa*, *C. ingens*, *C. silvae*, *C. valida*, *C. vini*, *C. norvegensis*, or *Torulopsis inconspicua*. Limited conjugation occurred between mating types of *P. kudriavzevii* and *C. krusei* and conjugation and sporulation occurred in mixtures with *C. sorbosa*. The data indicate *C. krusei* and *C. sorbosa* to be the same species and to represent imperfect forms of *P. kudriavzevii*.

3951 • Mycoviruses: Significance in Industrially and Agriculturally Important Fungi

R. W. Detroy
In "Microbiology 1976," Proc. Am. Soc. Microbiol. Conf., Orlando, Fla., February 15-18, 1976, pp. 563-564. 1976

Current information is reviewed involving biological significance of viruses in fungi of industrial and agricultural importance. Certain aspects of viruses upon host metabolic activity are emphasized.

3952 • Preharvest Development of Aflatoxin B₁ in Corn in the United States

M. S. Zuber,¹ O. H. Calvert,¹ E. B. Lillehoj, and W. F. Kwolek²

(¹University of Missouri Agricultural Experiment Station, Columbia;

²Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)

Phytopathology 66(9): 1120-1121. September 1976

A preharvest sampling of field corn at various locations in the United States showed B₁ aflatoxin content exceeding 20 ng/g. (20 p.p.b.) at three of 13 (23%) locations in 1972, four of 15 (27%) in 1973, and 11 of 21 (52%) in 1974. Some locations in Georgia and Texas had aflatoxin-contaminated corn in each of the three years. Also, there was a tendency for a much higher incidence of excessive aflatoxin B₁ in corn in the more southerly locations in the U.S. than in those farther north. Thus, there appear to be distinct regional differences in aflatoxin production in corn within the United States. It is evident that aflatoxin B₁ often is produced as a result of *Aspergillus flavus* infection of developing grain in the field.

3953 • A History of Sweeteners--Natural and Synthetic

G. E. Inglett

J. Toxicol. Environ. Health 2(1): 207-214. September 1976

Sweetness for the prehistoric man was the taste sensation obtained from sweet berries and honey. Man's quest for other sweet things led to sucrose, starch-derived sugars, and synthetic sweeteners. An unusual source of sweet taste is a West African berry known as miracle fruit (*Synsepalum dulcificum*). This fruit possesses a taste-modifying substance that causes sour foods--e.g., lemons, limes, or grapefruit--to taste sweet. The active principle was found to be a glycoprotein. Until this time, only small molecules were considered sweet-evoking substances, but now macromolecules are considered capable of participating in taste perception.

3954 • Polymer Distribution in Grafted Starch Granules by Scanning Electron Microscopy

G. F. Fanta, F. L. Baker, J. A. Stolp, R. C. Burr, and W. M. Doane
Staerke 28(11): 382-386. November 1976

The location of grafted polymer within the starch granule matrix was determined by scanning electron microscopy for two wheat starch graft copolymers prepared by cobalt 60-initiated graft polymerization of a mixture of acrylamide and *N,N,N*-trimethylaminoethyl methacrylate methyl sulfate (TMAEMA-MS). For a graft copolymer containing 16% synthetic polymer, prepared by the simultaneous irradiation of a starch-monomer mixture, grafting took place throughout most of the granule interior. However, a graft copolymer containing 31% synthetic polymer, prepared by reaction of preirradiated starch with

a water solution of monomers, was grafted largely near the granule surface. In contrast to starch-*g*-poly(acrylamide-*co*-TMAEMA-MS) prepared by simultaneous irradiation, irradiation of a starch-styrene mixture gave predominantly surface grafting. All graft copolymers had the outward appearance of starch granules, and this appearance was retained even after removal of the starch moiety by hydrolysis. The size distribution of wheat starch granules, as determined by Coulter measurements, was not greatly altered by graft polymerization of acrylamide-TMAEMA-MS; however, graft polymerization of styrene onto corn starch significantly increased granule size.

- 3955 • *Aspergillus oryzae* (NRRL Strain 1988): A Clarification
Dorothy I. Fennell
Science 194(4270): 1188. December 1976

This is a technical comment on El-Hag and Morse's article in Science, June 25, 1976, pp. 1345-1346.

- 3956 • Curvularin From *Penicillium baradicum* Baghdad NRRL 3754, and Biological Effects
R. F. Vesonder, A. Ciegler, D. Fennell, and L. W. Tjarks
J. Environ. Sci. Health Part B11(4): 289-297. 1976

Curvularin, a fungal metabolite similar in chemical structure to zearalenone, a potent estrogen, was tested for its estrogenic effects to gilts. No estrogenicity was observed to gilts after feeding curvularin *per os* at a rate of 10 mg per day for 5 days. Curvularin was also nontoxic to mice and chick embryos,

- 3957 • ¹⁴C-Labeled Aflatoxin B₁ Prepared with Yeastlike Cultures of *Aspergillus parasiticus*
Linda K. Jackson and Alex Ciegler
J. Environ. Sci. Health Part B11(4): 317-329. 1976

A simple method was developed to produce ¹⁴C-labeled aflatoxin B₁ by using the yeastlike phase of *Aspergillus parasiticus* NRRL 2999. Yeastlike cultures resulted from absence of manganese in a synthetic medium. Sodium acetate-1-¹⁴C had a 0.22% average incorporation; sodium acetate-1,2-¹⁴C, 0.70%. The average yield of labeled B₁ was 10 mg/500 ml medium with an average specific activity of either 63.3 mCi/mole (C-1 label) or 194.3 mCi/mole (C-1,2 label).

3958 • Amadori Compounds: Vacuum Thermolysis of 1-Deoxy-1-L-Proline-D-Fructose

F. D. Mills and J. E. Hodge

Carbohydr. Res, 51(1): 9-21. October 1976

Amadori compounds are important precursors of color and aromas in foods, and proline-sugar reactions have produced bready aromas in roasted cereals and baked goods. To produce the volatile aroma compounds, 1-deoxy-1-L-proline-D-fructose was heated under vacuum, first at 140° and then at 240°. Each distillate was condensed at -70°, and from them 22 compounds were identified by gas liquid chromatography-mass spectrometry, proton magnetic resonance, infrared spectroscopy, gas liquid chromatography, and synthesis. At 140°, there were major amounts of 6-carbon dehydration products (dihydrofurans, dihydropyrones, pyrones, and methylcyclopentenolone), lesser amounts of scission compounds (acetic acid and the pyrrolidine amides of formic, acetic, and propionic acids), substituted furfurylamines, a diazepine, proline, and pyrrolidines derived from proline. At 240°, the title compound yields more of the pyrrolidine derivatives, maltol, pyrrolidine amides of formic acetic, and propionic acids, a γ -lactone, and Δ^2 -pyrrolino substituted furans. Product aromas were determined and degradation schemes, based on the isolated products, were formulated.

3959 • Confirmation of Results of Rapid Screening Test for Aflatoxins Performed at Corn Elevator

O. L. Shotwell, G. M. Shannon, and M. L. Goulden

J. Assoc. Off. Anal. Chem. 59(6): 1419-1421. November 1976

A screening method for corn and corn products, based on a minicolumn, was modified slightly to assay 60 lots of corn at one elevator to determine whether they could be sold as animal feed. To be salable, the lots had to contain less than 20 p.p.b. total aflatoxin. Aflatoxin levels in the lots were later determined by the official AOAC method for corn to check effectiveness of the screening. No lot had been designated for sale that contained 20 or more p.p.b. total aflatoxin.

3960 • Rapid Analysis of Starch Graft Copolymers

R. J. Dennenberg and T. P. Abbott

J. Polym. Sci., Polym. Lett. Ed. 14(11): 693-696. November 1976

Starch graft vinyl copolymers have been treated with perchloric acid in hot glacial acetic acid to remove the starch portion of the copolymer. The vinyl polymer side chains are thus available for further quantitative analysis. Vinyl polymer side chains so treated are unaffected by this oxidative treatment as shown by infrared and viscosity studies.

3961 • Latexes of Starch-Based Graft Polymers Containing Polymerized Acrylonitrile

L. A. Gugliemelli, C. L. Swanson, W. M. Doane, and C. R. Russell
J. Appl. Polym. Sci. 20(11): 3175-3183. November 1976

The scope of graft reactions to produce starch-based latexes was extended by graft polymerization of acrylonitrile (AN) onto gelatinized cationic starch possessing quaternary amine functionality and by graft terpolymerization of AN and *t*-butylaminoethylmethacrylate (TBAEM) onto gelatinized starch by cerium(IV) initiation at 25° C. Grafting onto starches containing highly basic quaternary amines gave polyacrylonitrile [poly(AN)] grafts having about one-fourth the number-average molecular weight (\bar{M}_n) (178,000 to 232,000) of those produced by grafting AN onto starches containing the less basic tertiary amine groups. Sonification at 20 KHz of graft polymerization reaction mixtures having up to 8% solids reduced viscosities from 400 to 3000 cP to 10 to 40 cP. Diameters of dried particles measured about 300 to 1500 Å.

Shaker-type agitation during grafting onto starch having quaternary amine groups produced poly(AN) chains with lower \bar{M}_n values than those produced during blade-stirrer-type agitation. \bar{M}_n values of grafted poly(AN) decreased with increasing reaction time, degree of substitution of amine in the starch, gelation time of cationic starch at 95° C., and cerium(IV) concentration.

AN was copolymerized with TBAEM at molar ratios of 14 to 85:1 in grafting onto gelatinized starch to yield copolymer side-chain grafts analyzing 8 to 52:1 of polymerized AN to TBAEM moieties.

3962 • Graft Copolymers of Starch and Mixtures of Acrylamide and Acrylic Acid

R. C. Burr, G. F. Fanta, W. M. Doane, and C. R. Russell
J. Appl. Polym. Sci. 20(11): 3201-3204. November 1976

Simultaneous cobalt 60 irradiations of starch with mixtures of acrylamide and acrylic acid were performed with both granular and swollen starch. The resulting graft copolymers were characterized with respect to percent add-on and also the intrinsic viscosity (or number average molecular weight) and mole-percent acrylic acid in the grafted polymer. Although structurally similar to saponified starch-*g*-polyacrylonitrile copolymers, starch-*g*-poly(acrylamide-*co*-acrylic acid) copolymers did not exhibit their thickening and water absorbing properties. The copolymers did, however, function as flocculants for aqueous suspensions of diatomaceous silica and bentonite clay.

- 3963* • Experimental Porcine Nephropathy: Changes of Renal Function and Structure Perorally Induced by Crystalline Ochratoxin A
 P. Krogh,¹ F. Elling,¹ N. Gyrd-Hansen,¹ B. Hald,¹ A. E. Larsen,²
 E. B. Lillehoj, A. Madsen,² H. P. Mortensen,² and U. Ravnskov³
 (¹Royal Veterinary and Agricultural University, Copenhagen, Denmark;
²National Institute of Animal Science, Copenhagen, Denmark; ³University Hospital, Lund, Sweden)
 Acta Pathol. Microbiol. Scand. Sect. A, 84: 429-434. 1976

Nine pigs were fed crystalline ochratoxin A in amounts corresponding to a feed level of 1 mg per kg for 3 months. The only observable lesion developed was a kidney damage, identical to the naturally occurring porcine nephropathy. The changes of renal function was characterized by impairment of proximal tubular function, indicated by a decrease of the ratio Tm_{PAH}/C_{In} , of the ability to concentrate urine, and by an increased urinary excretion of glucose. The decrease of the ratio Tm_{PAH}/C_{In} is correlated with time of exposure to ochratoxin A. The changes of renal structure were characterized by degeneration of the proximal tubules, leading to tubular atrophy accompanied by interstitial fibrosis. At the end of the experiment the kidney, liver, adipose and muscular tissue of the slaughtered pigs contained sizable amounts of ochratoxin A residues. As the pigs would have passed the meat inspection this represents a possible health problem. The changes observed in this study are identical to those observed by feeding to pigs grains naturally contaminated with ochratoxin A.

- 3964* • Nematicides in Starch for Controlled Release
 Julius Feldmesser,¹ B. S. Shasha, and W. M. Doane
 (¹Plant Protection Institute, ARS, USDA, BARC-W, Beltsville, Maryland)
 Proc. 1976 Controlled Release Pesticide Symp., Akron, Ohio,
 September 13-15, pp. 6,18-6.29. 1976

Nematodes are difficult to kill because of their waxy cuticles and because many of them can persist due to physiological and physical factors such as relatively resistant dormant stages, penetration-resistant egg shells and leathery dead protective female skins known as cysts, and because they are often protected from the soil environment by layers of plant tissue. These factors help reduce the likelihood of nematicides reaching their targets.

Controlled release technology for nematicides promises numerous advantages including extended efficiency of lower total dosages, savings in labor and energy due to reduced need for frequent retreatments, and reduced unfavorable environmental impacts. In addition, new nematicide use patterns may develop. Slow or controlled release formulations may increase stability of otherwise impractically unstable compounds.

- 3965 • Agronomic Evaluation of Prospective New Crop Species. VI.
Briza humilis--Source of Galactolipids
 G. A. White,¹ B. C. Willingham,² Wheeler Calhoun,³ and
 R. W. Miller
 (¹Plant Genetics and Germplasm Institute, BARC, Beltsville,
 Maryland; ²University of California, Davis; ³Oregon State
 University, Corvallis)
 Econ. Bot. 30(3): 193-197, July-September 1976

Briza humilis Bieb., a low seed-yielding member of the family Gramineae, showed agronomic promise as a commercial source of galactolipids. The seed lipid contains about 80% galactolipids, compared to little, if any, in other evaluated species of *Briza*. An obligate winter annual, *B. humilis* is a small, noncompetitive grass with good seed retention. Seed (caryopsis) yields ranged from 280 to 1475 kg/ha. Clean threshing of the light-weight seed (0.5 g/1000) proved difficult. Because yield and plant size varied, agronomic improvements should be possible.

- 3966 • Agricultural Residues, Including Feedlot Wastes
 J. H. Sloneker
 Biotechnol. Bioeng. Symp. No. 6: 235-250. 1976

More than 600 million tons of residues are generated each year by our diverse agricultural industry. About 75% of this waste is left on the land at an average density of 1 to 1.5 tons per acre. This low density, plus the short time available for harvest, substantially increases the capital expenditures for harvesting equipment. Delivered to the processor, the residues will cost 30 to 40 dollars per ton. These figures include an equitable compensation to the farmer and the cost of hauling away unreacted processing waste. The residues contain between 40 and 70% carbohydrate consisting of various sugars--arabinose, xylose, mannose, galactose, and glucose--in the approximate ratio of 2:14:1:1:40, respectively. Before these residues can be used extensively, the effects of their continuous removal on soil fertility must be determined.

- 3967* • Fermentation Ethyl Alcohol
 Dwight L. Miller
 Biotechnol. Bioeng. Symp. No. 6: 307-312. 1976

Fermentation and synthetic ethyl alcohol may be used interchangeably for industrial purposes. Competitive economics control the production processes. Synthetic raw materials based on gas and petroleum are increasing at a higher rate than fermentable raw materials. The comparative economics of the two processes are reviewed.

- 3968 • Codeine and Morphine in *Papaver somniferum* Grown in a Controlled Environment
 H. L. Tookey, G. F. Spencer, M. D. Grove, and W. F. Kwolek¹
 (¹Biometrician, North Central Region, ARS, USDA, Peoria, Ill.)
 Planta Med. 30(4): 340-348. December 1976

Alkaloids in the terminal capsule of M-89 variety of *P. somniferum* rise and plateau as the plant matures in a controlled environment. Lancing immature capsules does not increase yield of codeine plus morphine in the above-ground plant, but lancing may translocate alkaloids upward to the capsule. Poppies produced a high proportion of codeine relative to morphine. This effect is probably due to some environmental condition imposed.

- 3969* • Present Situation and Future Outlook of Soy Protein Foods
 [In Chinese]
 Gus C. Mustakas
 Soybean Oil Process. 11(5): 42-46, May 1976

Interest centers around protein from soybeans for several reasons: (1) The yield of edible protein per acre of soybeans is one of the highest of all plant or animal protein sources. (2) The nutritional quality of soybean protein is one of the best available from plant sources. With the exception of methionine, soy protein is well balanced in the ten essential amino acids and is a valuable source of the B vitamins and essential minerals. (3) Soybeans can be grown in a variety of soils and under a wide range of climatic conditions. (4) There is an increasing need to design processed or fabricated foods with low-cost soy protein ingredients having improved functional properties. For example, soy protein can contribute such properties as emulsification, stabilizing, water-binding, thickening, gelling, fat-binding, cohesiveness, and texture.

During the past 40 years or so, research has shown that soybeans when properly processed, provide a valuable source of protein for feeding livestock and poultry. The protein in soybeans can also perform the same function in the diet of human beings at much less cost than most other sources of protein. By 1980, one marketing analyst predicts that processed foods will account for 75% of the U.S. diet. The escalating cost of animal protein foods, such as meat, milk, and eggs, is giving great impetus to the growth of soy proteins in the U.S. diet.

- 3970 • Iron Enrichment of Dry-Milled Corn Products
 R. A. Anderson, C. Vojnovich, and G. N. Bookwalter
 Cereal Chem. 53(6): 937-946. November-December 1976

Powdered iron, reduced either electrolytically or with hydrogen, can be added to common dry-milled corn products, such as grits or meal, at levels of 40 mg. iron per pound with little or no segregation of iron. Accelerated storage of grits and meal enriched at this level resulted in no adverse odors or flavors after 56 days. At the same levels, stabilized ferrous sulfate added to these products does not segregate appreciably, but flavor and odor deteriorate somewhat during storage. When iron levels were increased to 200 mg. per pound product, each iron source gave similar results. Neither appreciable migration of iron nor degradation of flavor or odor after storage occurred in soy-fortified corn meal enriched with either 40 mg. or 200 mg. iron per pound, as reduced iron or stabilized ferrous sulfate.

3971 • Wild Rice: Nutritional Review

R. A. Anderson

Cereal Chem. 53(6): 949-955. November-December 1976

The increasing conversion of wild rice to a domestic state holds much promise of making this crop of growing economic importance. Nutritionally, wild rice has several attributes that set it aside from many other cereals. Wild rice has a higher protein content than most cereals, as well as a balance of essential amino acids that more than meets FAO standards. These and other nutritional contributions of wild rice should become better known and properly utilized.

3972 • Structure of a Secoisolariciresinol Diester from *Salvia plebeia* Seed

R. G. Powell and R. D. Plattner

Phytochemistry 15(12): 1963-1965, December 1976

This report details the characterization of a unique lignan diester present in *Ocimum sanctum* seed. Hydrolysis of the diester yields ferulic acid, (+)-12L-methyltetradecanoic acid, and secoisolariciresinol. Secoisolariciresinol is known as a heartwood constituent in several genera, but the occurrence of this lignan as a seed component is previously unreported. Branched chain fatty acids, such as 12-methyltetradecanoic acid, are common in animal fats and microorganisms but are rarely reported from higher plants.

3973* • Starch Purifies PC Rinse Water

R. E. Wing

Circuits Manuf. 16(12): 10, 12, 14-16, December 1976

Since the electroplating industry will shortly have to meet stringent effluent guidelines, this paper describes several ways to remove heavy metals from printed circuit rinse water. Specific treatments will be discussed for electroless copper, copper pyrophosphate, and alkaline copper ammonia etch rinse waters. Some recommendations to the printed circuit manufacturers will be given.

3974* • Aflatoxin Production in Several Corn Hybrids Grown in South Carolina and Florida

E. B. Lillehoj, W. F. Kwolek,¹ A. Manwiller,² J. A. DuRant,²
J. C. LaPrade,² E. S. Horner,³ J. Reid,³ and M. S. Zuber⁴

(¹Biometrician, North Central Region, ARS, USDA, Peoria, Ill.;

²Clemson University, Pee Dee Experiment Station, Florence, S. Car.;

³University of Florida, Gainesville; ⁴ARS, USDA, University of Missouri, Columbia)

Crop Sci. 16(4): 483-485. July-August 1976

Susceptibility was studied of developing ears of several corn hybrids (*Zea mays* L.) to infection by *Aspergillus flavus* Link ex Fr. as determined by aflatoxin production. Five experimental single cross hybrids (SC) adapted for growth in the South and a single cross hybrid (A) adapted to the Corn Belt were grown in South Carolina and Florida. Treatments consisted of: (a) periodic spraying with an insecticide to control ear damage by insects; (b) inoculation of ears with *A. flavus* spores; (c) mechanical damage of ears to simulate insect damage; and (d) untreated controls. Cracked kernels from individual ears were examined for bright greenish-yellow fluorescence (BGY). Shelled corn from each treatment replication was combined, blended, sampled, and assayed for aflatoxin. The five SC hybrids exhibited a lower level of BGY occurrence and aflatoxin than hybrid A. Inoculating silks with *A. flavus* spores increased the incidence of BGY fluorescence and concentrations of aflatoxin. Corn from untreated control ears was extensively contaminated with aflatoxin. Insecticide reduced but did not eliminate insect damage and toxin development in field corn except for one hybrid (SC76 X SC413). Results suggest a relationship between insect damage and presence of the toxin.

REPUBLICATIONS

- 3406 • Insoluble Starch Xanthate (ISX), Preparation and Use in Heavy Metal Recovery
 [R. E. Wing]
 North. Reg. Res. Center, U.S. Agr. Res. Serv., CA-NRRC-41 (Rev. 2),
 7 pp. June 1976 [Processed]

This is a further revision of the Correspondence Aid originally issued in November 1973, and revised in August 1974.

- 3695 • Current and Potential Uses of Starch Products in Plastics
 F. H. Otey
 Polym. Plast. Technol. Eng. 7(2): 221-234. 1976

This paper was originally published in proceedings of Symposium on Renewable Resources for Plastics..., Division of Chemical Marketing Economics, 169th National American Chemical Society meeting, pp. 87-99, 1975.

- 3804 • Economic Potential of Kenaf Production
 C. A. Moore,¹ W. K. Trotter,² R. S. Corkern,³ and M. O. Bagby
 (¹ERS, USDA, Peoria, Ill.; ²ERS, USDA, New Orleans, La.; ³ERS,
 USDA, Athens, Ga.)
 Tappi 59(1): 117-120, January 1976

This material was originally published in the Tappi Committee Assignment Report No. 58, "Non-Wood Plant Fiber Pulping--Progress Report No. 6," pp. 73-80. Atlanta, Ga., October 1975.

CONTRACT AND GRANT RESEARCH PUBLICATIONS

[Report of research done by an outside agency under a grant from the U.S. Department of Agriculture and supervised by the Northern Regional Research Center.]

143-G* • Models for Depolymerizing Enzymes: Criteria for Discrimination of Models

John A. Thoma

University of Arkansas, Fayetteville

Carbohydr. Res. 48(1): 85-103. May 1976

144-G* • Subsite Mapping of Enzymes. Collecting and Processing Experimental Data--A Case Study of an Amylase-Malto-Oligosaccharide System

John A. Thoma and Jimmy D. Allen

University of Arkansas, Fayetteville

Carbohydr. Res. 48(1): 105-124. May 1976

[Report of research work supported with funds provided by the U.S. Department of Agriculture under the authority of U.S. Public Law 480, 83rd Congress, and sponsored by the Northern Regional Research Center.]

364-F • Decomposition of Soybean Oligosaccharides by Intestinal Bacteria, VII. α -Galactosidase Activity of a Few Other Intestinal Bacteria than *E. coli*

Sin'itiro Kawamura, Tadasi Kasai, and Sumizo Tanusi

Kagawa University, Kagawa, Japan

Tech. Bull. Fac. Agric. Kagawa Univ. 27(59): 117-124. March 1976

365-F • Purification and Properties of α -Galactosidase from *Escherichia coli* subsp. *communior* IAM 1272

Sin'itiro Kawamura, Tadasi Kasai, and Sumizo Tanusi

Kagawa University, Kagawa, Japan

Agric. Biol. Chem. 40(4): 641-648. April 1976

January-December 1976

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PATENTS

[These patents are assigned to the Secretary of Agriculture. Copies of patents may be purchased (50 cents each) from the Commissioner of Patents and Trademarks, U.S. Patent and Trademark Office, Washington, D.C. 20231. Order by number, do not send stamps.]

A Method of Reducing Water Content of Emulsions, Suspensions, and Dispersions with Highly Absorbent Starch-Containing Polymeric Compositions
Mary Ollidene Weaver, Edward B. Bagley, George F. Fanta, and William M. Doane
U.S. Patent 3,935,099. January 27, 1976

Starch-containing polymer compositions are prepared which absorb amounts of water equaling up to more than 1000 times their own weight. The compositions find many applications including their incorporation into products such as disposable diapers, surgical pads and sheets, and paper towels.

Method of Preparing Powdered Elastomer Compositions
Thomas P. Abbott
U.S. Patent 3,941,767. March 2, 1976

An improved process is used to prepare encased powdered elastomers which replace slab rubber in injection molding formulations and thereby eliminates the need for milling and high shear mixing. A composition is obtained which is easily blended and is capable of being automatically fed to injection molding machines, and which contains less encasement compound than prior art powdered elastomers having similar nonagglomerating and free-flowing properties.

Removal of Heavy Metal Ions from Wastewaters
Charles L. Swanson, Robert E. Wing, and William M. Doane
U.S. Patent 3,947,354. March 30, 1976

Concentrations of undesirable heavy metals in industrial wastewater are reduced to below or very close to the most stringent aqueous discharge limits. This is accomplished by forming an insoluble metal-polyelectrolyte complex which can be easily and economically removed from the effluent.

Degradable Starch-Based Agricultural Mulch Film

Felix H. Otey and Arthur M. Mark

U.S. Patent 3,949,145. April 6, 1976

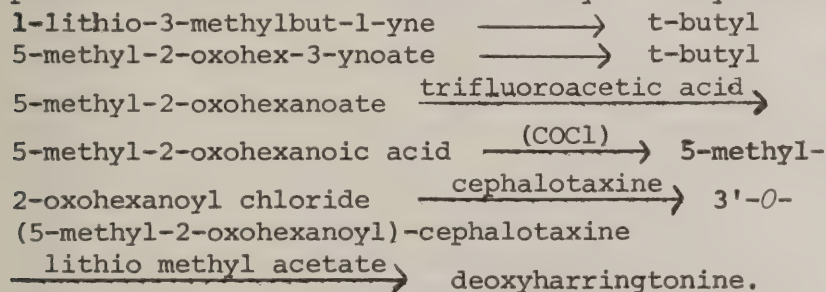
Disclosed herein are plastic film compositions for agricultural mulch which will withstand outdoor weathering conditions for a desired time and then rapidly disintegrate. The film composition comprises starch, poly(vinyl alcohol), glycerol, and a water-resistant coating.

Synthesis of Antitumor Alkaloid Deoxyharringtonine and Its Precursor 3'-O-(5-Methyl-2-oxohexanoyl)-cephalotaxine

Kenneth L. Mikolajczak and Cecil R. Smith, Jr.

U.S. Patent 3,959,312. May 25, 1976

The alkaloid deoxyharringtonine and its precursor 3'-O-(5-methyl-2-oxohexanoyl)-cephalotaxine were synthesized according to the following preferred series of reactions: Ethyl t-butyl oxalate +



Antibiotic Equisetin and Method of Production

Harland R. Burmeister

U.S. Patent 3,959,468. May 25, 1976

An antibiotic produced by *Fusarium equiseti* NRRL 5537 and given the trivial name equisetin is active against several genera of gram-positive bacteria.

Method of Preparing Feed Grain Compositions

Robert A. Rhodes, William L. Orton, and Bernard A. Weiner
U.S. Patent 3,968,254. July 6, 1976

Feed grain compositions are prepared from grain and feedlot wastes by fermentation procedures which are carried out in simple equipment suitable for use on the feedlot site. The procedures are also suitable for industrial scale operations. Fecal odor of the waste is quickly eliminated and replaced by one that resembles the odor of silage. The fermented product has significantly more crude protein than corn, and it is palatable to livestock.

Water-Soluble Graft Polymers Produced by an Outwardly Dry Radiation Polymerization Process

George F. Fanta and Robert C. Burr
U.S. Patent 3,976,552. August 24, 1976

A method was discovered of graft polymerizing water-soluble monomers with starch under conditions which are outwardly dry appearing. Conversion of monomer to polymer is nearly quantitative; and, since excess water is not present, there is no need for separate isolation and drying steps.

Removal of Heavy Metal Ions from Aqueous Solutions with Insoluble Cross-Linked-Starch-Xanthates

Robert E. Wing and William M. Doane
U.S. Patent 3,979,286. September 7, 1976

An insoluble-starch-xanthate composition is prepared which is capable of removing most heavy metal ions from aqueous solutions. Concentrations of heavy metal ions contained in several industrial effluents were reduced to below the most stringent aqueous discharge limits.

Highly Absorbent Starch-Containing Polymeric Compositions

Mary Ollidene Weaver, Edward B. Bagley, George F. Fanta, and William M. Doane
U.S. Patent 3,981,100. September 21, 1976

Starch-containing polymer compositions are prepared which absorb amounts of water equaling up to more than 1000 times their own weight. The compositions find many applications including their incorporation into products such as disposable diapers, surgical pads and sheets, and paper towels.

Diacetal Derivatives of Polyunsaturated Fatty Esters as Primary Plasticizers for Polyvinylchloride

Richard A. Awl and Everett H. Pryde

U.S. Patent 3,983,067. September 28, 1976

Acetal derivatives of polyunsaturated fatty compositions were prepared and found to function as primary plasticizers. Poly(vinyl chloride) resins plasticized by the compositions of the invention have properties equal or superior to resins plasticized by dioctyl phthalate or dioctyl sebacate.

Starch Graft Polymer Latexes

Lewis A. Gugliemelli, Charles L. Swanson, and Charles R. Russell

U.S. Patent 3,984,361. October 5, 1976

Starch graft polymer latexes as well as processes for their preparations are disclosed. The starch graft latexes are water-dispersed grafted starch particles (300-1500 Å in size) consisting of either (1) a cationic starch graft polymerized with up to 66% by weight of either nonionic or cationic vinyl monomers alone or with selected combinations thereof or (2) a non-ionic starch graft polymerized with a cationic monomer alone or in combination with nonionic monomers. The latexes, having a range of properties, dry at 25° C. or at higher temperatures to clear continuous films.

Immobilization of Enzymes with a Starch-Graft Copolymer

Mary Ollidene Weaver, Edward B. Bagley, George F. Fanta, and William M. Doane

U.S. Patent 3,985,616. October 12, 1976

Enzymes are immobilized by entrapment or by covalent bonding with alkali saponified gelatinized-starch-polyacrylonitrile graft polymers. The polymers absorb amounts of water equaling up to more than 1000 times their own weight. In addition to immobilizing enzymes, the polymers find many applications including their incorporation into products such as disposable diapers, surgical pads and sheets, and paper towels.

Bis(methyl *n*-octadecanoate-9(10)-yl) Sulfides and Methods, Lubricant Compositions

Arthur W. Schwab and Lyle E. Gast

U.S. Patent 3,991,089. November 9, 1976

Load-bearing lubrication compositions are prepared by adding to lubricating oil base stocks small amounts of sulfurized oleic alkyl esters of sulfurized alkyl esters of oleic acid-containing vegetable oils. A method of preparing the sulfurized fatty compounds is also disclosed.

Highly Absorbent Starch-Containing Polymeric Compositions

Mary Ollidene Weaver, Edward B. Bagley, George F. Fanta, and William M. Doane

U.S. Patent 3,997,484. December 14, 1976

Starch-containing polymer compositions are prepared which absorb amounts of water equaling up to more than 1000 times their own weight. The compositions find many applications including their incorporation into products such as disposable diapers, surgical pads and sheets, and paper towels.

LICENSING OF PATENTS

Many inventions and discoveries of the Northern Laboratory are covered by patents assigned to the Secretary of Agriculture.

Assigned patents are available for use by business and industry under either exclusive or non-exclusive licenses. Conditions

applicable to the granting of licenses are set forth in the Federal Register, May 14, 1970 [35(94): 7493-7495]. Further information can be obtained from the Administrator, Agricultural Research Service, U.S. Department of Agriculture, Washington, D.C. 20250

The Northern Regional Research Center is part of the Agricultural Research Service of the U.S. Department of Agriculture. Congress in 1938 authorized four regional laboratories to conduct broad and complex investigations in the field of chemistry and related physical sciences to expand and improve the marketability of agricultural commodities. The addresses and commodities covered are:

Laboratory

Principal Fields of Research

Eastern Regional Research
Center
600 East Mermaid Lane
Philadelphia, Pennsylvania 19118

Animal products: Dairy, meats, fats, and leather. Plant products: Eastern fruits and vegetables, along with honey.

Northern Regional Research
Center
1815 North University Street
Peoria, Illinois 61604

Corn, wheat, grain sorghum, oats, soybeans, flax, crambe, and new crops.

Southern Regional Research
Center
P.O. Box 19687
New Orleans, Louisiana 70179

Cotton and cottonseed; sweet potatoes; rice; grain sorghum, peanuts, and cane sugar.

Western Regional Research
Center
Berkeley, California 94710

Western fruits, tree nuts, and vegetables; poultry products; forage crops; wheat, barley, rice; wool and mohair; dry beans and peas; castor beans; and safflower.

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